

The Flexible Approach!

An Analysis of Stretching



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What exactly is flexibility? Flexibility can be defined as the range of motion of a joint or a series of joints that are influenced by muscles, tendons ^{Glos.1}, ligaments ^{Glos.2}, bones and bony structures. This definition suggests that flexibility is not something general, but is specific to a particular joint or set of joints. Hence, it cannot be said that a person is “naturally” flexible throughout his or her whole body. Being flexible in the lower body, for example does not imply that one is flexible in the upper body. Hence, It is necessary to delve a little deeper to establish what exactly we are saying if we pronounce a person as being flexible.



Rear Thigh Dynamic Stretch

Primary Muscles Stretched: biceps femoris, semitendinosus, semi membranous
Secondary Muscles Stretched: iliopsoas, spinor erectae, gluteus, medius, gluteus maximus, gluteus minumus



Front Thigh Static Passive Stretch

Primary Muscles Stretched: rectus femoris, vastus lateralis, vastus intermedius, vastus medialis, iliacus .**Secondary Muscles Stretched:** sartorius, adductor longus, adductor brevis, tensor fasciae latae, obturatorius internus, gracilis, iliapsoas.

It is pointed out by Tom Kurz ^(Ref. 8) that there are actually a number of different types of flexibility, those being

dynamic flexibility, static-active flexibility and static-passive flexibility. These are outlined:

- (i) Dynamic flexibility: involves motion. It is the ability to perform dynamic movements of the muscles to bring a limb through its full range of motion in the joints.
- (ii) Static-active flexibility: is the ability to assume and maintain extended positions using only the agonists^{Glos.3} and synergists^{Glos.4} while the antagonists^{Glos.5} are being stretched, e.g. lifting the leg and keeping it high without any other support apart from one's own leg muscles.
- (iii) Static-passive flexibility: is the ability to stretch various muscles and then maintain this position using only your body weight, or some equipment (e.g. a chair). The key difference between static active and static passive flexibility is that in the latter, the ability to hold the position does not come from the muscles alone.

It is argued that stretching is a vital part of most exercise routines, and that some of the benefits include:

- Enhanced physical fitness
- Increased mental and physical relaxation
- Enhanced development of body awareness
- Enhanced ability to learn and perform skilled movements
- Reduced muscular soreness
- Reduced risk of injury to joints, muscles and tendons
- Reduced muscular tension

This suggests that stretching has rewards and is useful in developing good flexibility in any sport. It is particularly important in the martial arts to stretch as part of a workout due to the very nature of the activity. There is a great deal of kicking exercises in many of the martial arts, which require suppleness particularly in the lower body. This makes stretching a requirement as well as being an activity with potential benefits.



Rear Thigh/Lower Back Dynamic Stretch

Primary Muscles Stretched: biceps femoris, semitendinosus, semi membranous
Secondary Muscles Stretched: iliopsoas, spinor erectae, gluteus, medius, gluteus maximus, gluteus minumus



Inner Thigh Static Passive Stretch

Primary Muscles Stretched: Adductor longus, adductor magnus.
Secondary Muscles Stretched: Adductor brevis, sartorius.

It is forwarded that though some stretch everyday, they do not always stretch properly. Some of the most common errors in stretching include:

- Improper warm-up^{Glos.6}
- Inadequate rest between workouts
- Overstretching^{Glos. 10}
- Performing unsafe exercises

Correct methods of stretching will be outlined below, however a basic description of the body organs that determine how flexible you are will now be discussed.

The muscles of the body consist of many muscle fibres, which are arranged, in parallel bundles. The basic units of a muscle are called sarcomeres. When a muscle contracts, two kinds of proteins in the sarcomeres of its cells slide along each other. The proteins are called actin and myosin. Whole muscle is encased in a fibrous connective tissue sheath called epimysium. Tendons are extensions of the muscle tissue and are attached to the various bones of the body. They consist of fibrous connective tissue; have great strength, and very little ability to contract. The joint capsule is a connective tissue sleeve that completely surrounds each movable joint. The joints are held together by ligaments, which consist mostly of collage fibres. Stretching ligaments is hazardous as it can destabilize joints and lead to osteoarthritis.



Inner Thigh Static Passive Stretch

Primary Muscles Stretched: adductor magnus, adductor brevis.

Secondary Muscles Stretched: gracilis, pectineus, adductor longus.



Outer Hip Static Passive Stretch

Primary Muscles Stretched: gluteus maximus, gluteus medius, gluteus minimus.

Secondary Muscles Stretched: tensor fasciae latae.

It is argued that the factors affecting flexibility vary. The principle factors are the bony structure of the joint, the amount of tissue around the joint, and the elasticity of muscles, tendons, and ligaments around the joint. The latter factor is the major limitation to flexibility. The joint capsule, tendons and ligaments consist mainly of inelastic connective tissue and account for 47% of the total resistance encountered by a joint during movement (Ref. 10). Age also affects flexibility. Children and adolescents are generally more flexible than adults. A decrease in flexibility occurs in the mid twenties for men and mid thirties for women. Gender is a factor also. Women tend to be more flexible than men because hormones, which help to facilitate women's tissues to stretch during childbirth, facilitate all body stretching.

As has been outlined above, there are different types of flexibility. Also, there are also different types of stretching. They are either dynamic or static. Dynamic stretches can improve dynamic flexibility and static stretches can improve static flexibility (and to a lesser degree, dynamic flexibility also). The different kinds of stretching are;

1. Ballistic Stretching:

Ballistic Stretching uses the momentum of one's body or a limb to force a muscle or joint beyond its normal range of motion. It is usually done in a "bouncing" motion, e.g. bouncing down repeatedly attempting to touch the toes. This form of stretching is not very valuable and usually only leads to injury by straining the related muscles. In the example just given, it would not be unusual to have resulting lower back and knee injuries also.

2. Dynamic Stretching:

Dynamic stretching must not be confused with ballistic stretching. Dynamic stretching involves controlled arm or leg swings that gently take the relevant limb to the limits of (but not beyond) its normal range of motion. There is no bouncing or jerking motion involved.

3. Active Stretching:

Active stretching is often alternatively referred to as static-active stretching. It is when one assumes a stretched position and maintains this position using the strength of the agonist muscles.

4. Passive Stretching

Passive Stretching is also known as relaxed stretching or static-passive stretching. This form of stretching involves assuming a position and then holding the position with the aid of one's hands or a partner, etc. The splits is an example of a passive stretch.

5. Isometric Stretching

Isometric stretching is a type of stretching which involves the resistance of muscle groups through isometric contractions (tensing) of the stretched muscles. This form of stretching is one of the quickest and more effective ways to develop static-passive flexibility. Isometric stretching also helps develop strength in the tensed muscles.

There are three ways to apply resistance for an isometric stretch:

? Use your own limbs manually. E.g. flexing one arm to isolate your bicep while applying resistance to the palm of the stretched arm using the opposite palm.

? Use a partner to provide resistance. E.g. a partner lifts your leg up high while you try to force the leg back down.

? Use external equipment to supply the required resistance. E.g. use a wall when stretching the

Gastrocnemius muscle, i.e. push-the-wall-stretch.

Isometric stretches may be dangerous to heart patients because it has been shown that they cause a marked rise in blood pressure and may produce irregular heartbeats. People with high blood pressure or heart trouble, or women who are pregnant should not perform isometrics.

6. PNF Stretching

PNF stretching is even more effective at developing static-passive stretching than isometric stretching. PNF is an abbreviation of Proprioceptive Neuromuscular Facilitation. It is basically a combination of isometric and static-passive stretching, usually with the help of a partner. It is performed as follows: A chosen muscle group or muscle is passively stretched and then contracts isometrically against resistance provided by the partner. After this "tension" has been held (normally for 7-10 seconds) there is an increase in the range of motion, through which the muscle group is taken by passively stretching again. PNF stretching can be done without a partner, however it is more effective with one. It also has the effect of increasing static-active flexibility as well as static-passive flexibility due to the strengthening of the muscles.

It should be noted that neither isometric nor PNF stretching is recommended for children or teenagers. Because their bodies are still developing there is a high risk of damaging connective tissue and/or tendons.



Inner Thigh Static Passive Stretch

Primary Muscles Stretched: Adductor longus, adductor magnus.

Secondary Muscles Stretched: Adductor brevis, sartorius.



Front Thigh/Hip Static Passive Stretch

Primary Muscles Stretched: rectus femoris, vastus lateralis, vastus intermedius, vastus medialis, iliopsoas.

Secondary Muscles Stretched: sartorius, adductor longus, adductor brevis, tensor fasciae latae, obturatorius internus, gracilis.

It is now important to highlight some contraindications to stretching.

In his book Sport Stretch, Michael J. Alter sites the following contraindications for stretching:

- If a bone blocks motion.
- One has had a recent fracture of a bone.
- An acute inflammatory or infectious process in or around a joint is suspected or known.
- Osteoporosis is suspected or known.
- There is sharp, acute pain with joint movement or muscle elongation.
- One has had a recent sprain or strain.
- One suffers from certain vascular or skin diseases.
- There is a loss of function resulting in a decrease of range of motion.

Some of the main errors in stretching were highlighted above. While stretching is good for the body in general, and vital in the martial arts, it has been shown to be counter-productive if not done properly.

Some guidelines for a safe and effective stretching programme are:

- It is recommended to stretch only a warm muscle. Plenty of stretching should be done at the end of a workout as part of a cool down, however some individuals feel more prepared for a workout by including stretching as part of their warm up.
- In the martial arts due to the nature of the workout, stretching is a large part of the preparatory section of a workout, to prevent injury.
- To avoid risk of injury avoid bouncing movements.
- Stretch to the point of discomfort and not pain.
- Hold static stretches for 10-30 seconds.
- For athletes: stretch all year round to maintain flexibility.
- It is important to assess your progress to ensure that the stretching program is actually improving your

flexibility.

In order to avoid the previously mentioned problems and encompass the given guidelines, this section will set out some of the methods to gain the maximum benefit from a stretching routine. These include;

- (A) Warming up
- (B) Cooling Down
- (C) Duration
- (D) When to stretch
- (E) Breathing
- (F) Strength and Flexibility

(A) Warming up

It is put forward that stretching is NOT warming up, but that it is a very important part of it. A correct warm up will raise body temperature and prepare the body for the main part of the workout. A warm up is categorised into (1) General warm-up (2) stretching (3) workout related activity

1) General Warm-up: should precede stretching and include joint rotations (to lubricate joints and facilitate motion e.g. knees, shoulders, neck, hips etc.) and light aerobic activity. The aerobic activity serves to increase the heart rate and blood flow, which improves muscle performance and flexibility.

2) Warm-up stretching: should consist dynamic stretches. It is safer to start with slow dynamic stretches, as static stretches early in a workout can be counter-productive, and can result in injuring the muscles. For the dynamic stretches, perform arm and leg swings to bring the limbs to their full range of motion.

3) Workout Related Activity: is based on the type of workout that will be performed. The Health For Life Training Advisor (HFLTA) says that the last phase of a warm-up should consist of the same movements that will be used during an athletic event but at a reduced intensity. E.g. in a martial arts class that will involve a lot of kicking exercises, it is a good idea practise a less intensive version of the kicks you will be performing.

(B) Cooling Down

Stretching should comprise only part of a warm up, the same applies with a cool down, i.e. it is only part of the process. According to Tom Kurz, to reduce muscle soreness, it is necessary to perform low intensity exercises followed by dynamic stretches (which allows the heart rate to slow down to its normal rate). Some static stretching can then follow this.

(C) Duration

A frequently debated point is how long one should hold a passive stretch. Research varies and suggests that it can be anything from ten to sixty seconds (or even several minutes). Many researchers recommend thirty to sixty seconds. A compromise would seem to be about twenty seconds, however Józef Drabik discourages this duration for children and people whose bones are still growing. He recommends a duration of about seven to ten seconds for this group of people. In one study ^(Ref. 9), the stretch duration was examined for its effect on hip flexibility. There were three groups examined. One group held the prescribed stretches for ten seconds. Another held the stretches for twenty seconds, and a third group held the stretches for thirty seconds. All three groups demonstrated increased hip flexibility with no significant differences between the three groups. It was concluded that a duration of ten seconds for static stretching is sufficient for improving static flexibility.

The varying opinions suggest that this discussion will continue for some time to come.

(D) When to Stretch

As indicated earlier, the proper time to stretch is when the muscles are well warmed up. Extra care must be taken when warming up for martial arts training particularly in cold weather due to the increased risk of muscular damage. Ideally stretching should be done in a warm environment. When this is not possible, it is suggested that the muscles must be warmed up very gradually.

Some experts refer to an "internal clock" with which one will identify themselves as being, for example, morning persons or night persons. Tony Gummerson, states that most people are more flexible in the afternoon than in the morning. According to HFLTA, there is evidence also that strength and flexibility are peaked in the late afternoon or early morning.

It is also suggested that it is advantageous to stretch at regular intervals during the day to enhance general living e.g. at work to release nervous tension, after standing or sitting for a long time, when you feel stiff.

(E) Breathing

Experts argue that correct breath control is crucial for successful stretching as well as other workout activities. It helps to relax the body and bring enough oxygen and nutrients to the muscles through increased blood flow. While stretching, the breathing should be relaxed, exhaling as you increase the stretch. Some experts recommend that the intensity of a stretch should be increased only when exhaling (apart from isometric stretching). The correct way to breathe is as follows; Inhalation should be done through the nose, as this has the function of filtering the air and ensuring optimum temperature and humidity for oxygen transfer in the lungs. The exhalation should be done in a slow, controlled manner.

(F) Strength and Flexibility

In her book *Stretch and Strengthen*, Judy Alter recommends stretching muscles after strength exercises and vice versa. This to prevent the connective tissue becoming so loose that it weakens. When the connective tissue of a muscle is weak, there is an increased risk of injury. It should also be noted that if working on increasing flexibility, then one should ensure that any strength exercise moves the joints through the full range of motion. According to Tom Kurz, repeating movements that do not employ a full range of motion in the joints (e.g. push-ups, cycling) can cause shortening of the muscles surrounding the joints. There will be a more in-depth discussion on the relationship of strength training to flexibility training later.

It is argued that the stretches recognised as being the most beneficial are based on safety, variation of training routine, increase of flexibility, and your level of flexibility. The main muscle groups that should be stretched are:

- Back
- Sides (external obliques)
- Neck
- Forearms and wrists
- Triceps^{Glos. 12}
- Chest (Pectorals)^{Glos. 11*}
- Buttocks (Gluteals)^{Glos.14}
- Groin (adductors)
- Thighs (quadriceps and abductors)
- Calves (gastrocnemius and soleus)
- Shins
- Hamstrings^{Glos. 13}

If one does not have the time to stretch all of them, then one should at least seek to stretch the muscles that will be most heavily worked out in the training session.

There are also a few “contentious” exercises. They are described by M. Alter as x-rated due to the risk of injury associated with them. They are as follows;

The Hurdler's Stretch

Description: In this exercise one is in a sitting position with one leg outstretched in front of you with the other leg flexed and tucked in behind you. You lean forward over the front leg to stretch the front hamstring and groin, while leaning back stretches the quadriceps of the flexed leg.

Dangers: Both stretched positions can result in stretching the medial ligaments of the knee (remember ligaments and tendons are relatively inelastic, so stretching is them not advised) and can crush the meniscus. It may also cause strain in the groin and lower back.

Straight-Leg Toe Touches

Description: With this exercise, both legs are straight and one leans forwards in an attempt to touch your toes or the floor. The feet can be either together or spread apart.

Dangers: The knees are in danger of hyperextension, which can also result in excessive pressure on the lumbar vertebrae. If the knees are spread apart, then this increase the pressure put on them.

Leg Stretches on a bar

Description: This is when the leg is placed on a bar or other form of support and the trunk is bent over the leg.

Dangers: If the leg is at an angle from the ground of more than ninety degrees, this exercise may lead to sciatica and piriformis syndrome, especially in someone who has limited flexibility. It is much safer to keep the angle under ninety degrees.

Standing Quadriceps Stretch

Description: This is an exercise whereby you are standing upright and flex one leg as you grip the foot, while balancing on the other leg. The aim is to stretch the quadriceps (the front of the thigh).

Dangers: If the knee is hyperflexed 120 degrees or more, the ligaments and joint capsule are apt to be stretched and the cartilage may be damaged. Also the main muscle of the quadriceps group, the rectus femoris, is not stretched because it crosses the hip as well as the knee joint. The risk can be largely rectified however by pushing the pelvis forward and easing the flexing of the knee.

The following are some guidelines that should be followed to avoid hazardous stretching exercises:

- Do not hyperflex the knee or neck.
- Do not hyperextend the knee, neck, or lower back.
- Do not twist the knee.
- Avoid overstretching any joint.
- Avoid fast, forceful hyperextension and flexion of the spine.
- If one is stretching with a partner, ensure that the partner is someone that can be trusted trust and is responsive to various signals.

The importance of strength training in developing a high level of flexibility is often overlooked by instructors and students alike. The development of strength in relation to flexibility is important on two levels. The first level is in originally developing one's flexibility. Strong muscles allow a greater degree of flexibility. The physiology is as follows: when a muscle is stretched it invokes a natural reaction called the stretch reflex—the muscle tenses to prevent overstretching. This is the severe muscular tension felt when doing for instance, front or side splits. However by combing isometric stretching and strength training for the primary muscle groups you want to stretch, over time you can decrease the intensity of the stretch reflex. This allows one to stretch further, with less discomfort. However to continue progressing, it is necessary to continue to do the isometric stretches and strength exercises for the legs and trunk such as squats, lunges, deadlifts, leg extensions, leg curls, adductor flies.

In conclusion, it is necessary to return to a previous section - the relevance of the placement of a stretching program in a workout. It is recommended by many experts that following a warm-up only a brief stretch is necessary and that an intensive stretching routine should only take place after the main body of a workout. This is largely due to the reason that too long a stretching routine after the warm-up can allow the heart rate to return close to normal levels and therefore lose the benefit of the warm-up. However, in martial arts classes that employ a large amount of kicking exercises it is advisable to stretch extensively before moving into the main part of the workout, in order to avoid injuring even tearing the muscles. There would also be a good amount of stretching at the end of the workout. This conflict can be reconciled by utilising the various types of stretching. It is recommended (Ref 8) to perform dynamic stretches after the general warm up in a workout, as this type of stretching most resembles the focus of the workout. The broad range of motion used ensures that the heart rate remains raised and so the benefit of the warm-up is not lost. After the workout, static stretching should be applied to allow the athlete to recover form the workout. This begs the question as to which placement can lead to the greatest level of flexibility.

Dr. Cornelius and various associates at the University of North Texas ^{Ref. 12} considered this conundrum. A study was undertaken to examine the placement of a static stretching program in an exercise routine. This was to determine which placement (before or after the workout) was more effective in increasing joint range of motion. Forty-eight female volunteers were divided into four groups, a control group, one which stretched before the workout, another group which stretched after the workout, and a fourth group which stretched before and after the workout. Pre and post flexibility measurements were taken and the result indicated that there was a marked increase of flexibility in all three experimental groups, with placement of the stretching routine not being a significant factor.

Conclusion

Stretching is a crucial part of any exercise regime, particularly Taekwon-do, not only for the development of the necessary flexibility, but also due to its role in preparation for and recovery from workouts. However, like any exercise, stretching if not done logically and rationally can cause more harm than good. Therefore, it is necessary to plan and perform stretching routines carefully, if one is to reap the maximum benefit.

Glossary

- | | |
|-------------|-------------------------------------|
| 1. Tendon | Tissue that connects muscle to bone |
| 2. Ligament | Tissue that connects bone to bone |

3. Agonist For movement to occur, the agonist (also called prime mover) contracts, shortens while a reciprocal lengthening of its antagonist occurs. E.g. when the bicep contracts, its opposite, the triceps relaxes and lengthens.
4. Synergist These muscles perform, or assist in performing, the same set of joint motion as the agonists. Synergists are sometimes referred to as neutralizers because they help cancel out, or neutralize, extra motion from the agonists to make sure that the force generated works within the desired plane of motion.
5. Antagonist These muscles act in opposition to the movement generated by the agonists and are responsible for returning a limb to its initial position.
6. Warm-up Preparing the body and mind for a workout. It should raise the body temperature and heart rate as well as loosen out the joints and muscles for training.
7. Contractions
Isometric contraction:
 This is a contraction in which no movement takes place, because the load on the muscle exceeds the tension generated by the contracting muscle. This occurs when a muscle attempts to push or pull an immovable object.
- Concentric contraction:
 This is a contraction in which the muscle decreases in length (shortens) against an opposing load, such as lifting a weight up.
- Eccentric contraction:
 This is a contraction in which the muscle increases in length (lengthens) as it resists a load, such as lowering a weight down in a slow, controlled fashion.
8. Bicep Muscle in the upper arm.
 Origin: shoulder and scapula
 Insertion: radius
 Action: flexion and supination of lower arm
9. Gastrocnemius Muscle in the lower leg.
 Origin: femur
 Insertion: Achilles calcaneus
 Action: knee and plantar flexion
10. Overstretching Stretching at too high an intensity and risking torn tissue
11. Pectoralis Chest muscles
 Origin: Sternum and clavicle
 Insertion: Humerus
 Action: Adduction of humerus
12. Triceps Muscles of rear thigh – main one is biceps femoris
 Origin: Ischium
 Insertion: Tibia
 Action: Hip extension and lower leg flexion
13. Hamstring Muscles of rear thigh – main one is biceps femoris
 Origin: Ischium
 Insertion: Tibia
 Action: Hip extension and lower leg flexion
14. Gluteals Buttocks (consist of maximus, medius and minimus)
 Origin: Ilium and sacrum
 Insertion: Femur
 Action: Extension and outward rotation of humerus

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