FUNCTIONAL RANGE OF MOTION
DISCLAIMER

This work and/or manual are not designed to diagnose any medical conditions. Please refer to a qualified healthcare professional.
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Good biomechanics require that range of motion be adequate, not excessive. Many people assume, erroneously that if a little flexibility is good, then a lot is better. Central to the understanding of joint mechanics is that stability is sacrificed for flexibility (and vice versa). Highly skilled athletes, such as gymnasts and martial artists may require greater than average flexibility, but their excessive range of motion is often detrimental to their health.

The terms flexibility and range of motion are often used interchangeably. To be more precise, flexibility should be considered the ability to readily adapt to changes in position or alignment, it usually expressed as normal, limited, or excessive.

Range of motion usually refers to the range at which a joint can be moved. It is often expressed in degrees.

Finally, joint range of motion is different than range of muscle length. As mentioned above, joint range of motion is the number of degrees present at a joint. Range of muscle length refers to the length of a muscle. For one-joint muscles, the range of motion is equal to that of range of muscle length. For two-joint muscles, the normal range of muscle length is less than the sum of the range of motion of the joints that it crosses.
FACTORS AFFECTING FLEXIBILITY

Joint Architecture

Joint range of motion is specific to a particular joint. Ball and socket joints, like the shoulder and hip joint allow for great range of motion in many planes. The knee and elbow joints are hinge joints and are limited to one degree of freedom that only permit appreciable range of motion in one direction.

Inherent to the concept of joint architecture is the influence of the soft tissues (muscle/ligaments/tendons) surround the joint. For example, the strong ligaments surrounding the hip joint limit the range of motion especially in extension. In fact, the joint capsule is said to account for 47% of a joint's total resistance to movement. Bone, muscles, ligament and joint capsule, tendon, and skin determine the range of motion for any joint. tendons and ligaments provide 10% of the total resistance experienced by a joint during movement. Muscle and its fascia account for 41% and skin accounts for 31%.

Activity Levels

The more active the individual, the greater their ROM. Immobilization which occurs in inactive people, causes the connective tissue to shorten. Habitual movement patterns of an individual are also important as the joint and surrounding tissues adapt to the same movements. Using the joints and muscles in the same activity pattern or maintaining habitual body postures may restrict range of motion owing to the tightening and shortening of the muscle tissue. This is similar to the inactive individual.

Injuries

Scar tissue due to injury and chronic inflammation may reduce movement. It is less compliant than undamaged tissue. Pain related to disease may also limit an individual`s range of motion.

Gender

Gender has been purported to play a role in flexibility. Evidence suggests that women have greater flexibility than men. The female is designed this way, especially in the pelvic region to assist in pregnancy and childbirth. Women tend to have lighter and smaller bone composition that allows greater movement. Women also tend to have smaller and less-defined muscles, thus allowing freer range of movement.

Age

Researchers have shown that muscles have less elasticity and flexibility with age. This trend can be attributed to structural changes that occur with age, such as muscle atrophy and increased fat deposition. Furthermore, activity levels decrease as we age, further contributing to decreased flexibility. Finally, disease processes such as osteoarthritis, may contribute to a reduction in flexibility.
Authorities have now included another classification as it applies to muscles: tonic (postural) or phasic (dynamic).

**Tonic** muscles are predominately type I or slow-twitch fibres. They consist of many mitochondria and thus, their oxidative capacity is quite high. More importantly, however, is that they are innervated by small, alpha a2 motor nerves. In other words, they are easily stimulated. This characteristic is important as these muscles must receive constant messages in order to control and correct posture. With this, comes a downside. Due to their relative ease of activation, these muscles are constantly firing, resulting in short, tight muscles.

**Phasic** muscles, on the other hand, consist mainly of type II or fast-twitch fibres. Due to their innervation by large, alpha a1 motor nerves, they require more stimulation to become active. Once activated, however, they have a greater capacity for force generation, but fatigue easily. This class of muscle is not designed to take on a postural or endurance role. Dysfunction of phasic muscles is manifested by weakness and inhibition, rather than tightness.
## Table 1. Characteristics of Tonic and Phasic Muscles

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<tr>
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<th>Tonic</th>
<th>Phasic</th>
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<tr>
<td><strong>Prone to Hyperactivity</strong></td>
<td>Prone to hyperactivity</td>
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<td><strong>Function</strong></td>
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<td><strong>Susceptibility to Fatigue</strong></td>
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<td><strong>Reaction to Faulty Loading</strong></td>
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<td>Tonic</td>
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<td>Iliopsoas</td>
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<td>Rectus Femoris</td>
<td>Gluteus Medius</td>
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<td>Hamstrings</td>
<td>Gluteus Medius</td>
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<td>Piriformis</td>
<td>Vasti (Medialis/Lateralis)</td>
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<td>Tensor Fascia Latae</td>
<td>Tibialis Anterior</td>
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<td>Gastrocnemius</td>
<td>Fibularis</td>
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<td>Soleus</td>
<td>Rhomboideis</td>
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<td>Upper Trapezius</td>
<td>Middle and Lower Traps</td>
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<tr>
<td>Pectoralis Major</td>
<td>Tricep Brachii</td>
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<td>Pectoralis Minor</td>
<td>Deltoid</td>
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<td>Levator Scapula</td>
<td>Supraspinatus</td>
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<td>Bicep Brachii</td>
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<td>Subscapularis</td>
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<td>Obliques</td>
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<td>Transversus Abdominus</td>
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The term stretch means to elongate or increase in length. The implied meaning should however, include the disclaimer: the elongation does not extend beyond the normal length of the muscle.

There are as many postulated benefits to stretching as there are different types of stretching. Before addressing the benefits (and risks) of stretching, let’s explore what happens at the physiological level.

**Stretch Reflex**

When a muscle is stretched, organs known as muscle spindles, a type of proprioceptor, increase their firing rate. These muscle spindles monitor the length of the muscle, noting both the force and rate of the stretch. Activation of the muscle spindle causes a contraction of its corresponding (agonist) muscle. Subsequently, the stretch reflex causes subsequent relaxation of the opposite or antagonist muscle(s).

**Hysteresis and Creep**

All tissues (and materials for that matter) are subject to the phenomena, hysteresis and creep. Hysteresis refers to the change and length of a tissue when a force, such as a stretch is applied to it. Creep, is the resultant or permanent deformation as a result of this stretch. Constant stretching can cause muscles, tendons, and ligaments to undergo both hysteresis and creep, often a goal of rehabilitation. However, if these tissues are already at a normal length, the increased length may increase one’s susceptibility to injury.
Benefits of Stretching

Stretching recommendations are unfortunately, clouded by misconceptions and conflicting research reports. The vast majority of experts attribute the benefits of stretching to a decrease in muscle stiffness and/or a reflex inhibition with subsequent viscoelastic changes.

Postulated benefits include:

1. Restoration of normal joint motion
2. Restoration of normal muscle length
3. Pain relief
4. Increase circulation
5. Improve efficiency of movement
6. Reduction of emotional stress
7. Injury prevention
8. Improvement of athletic performance
9. Reduction of risk of cramps and spasms

Let’s see what the research has to say.

Prolonged static stretching has been shown to reduce muscle tonicity.


Yeh CY; Tsai KH; Chen JJ. Effects of prolonged muscle stretching with constant torque or constant angle on hypertonic calf muscles. Archives of physical medicine and rehabilitation. 2005 Feb; Vol. 86 (2), pp. 235-41.

Practitioners, coaches and therapists have suggested that static stretching can reduce the soreness associated with DOMS. There have no studies to substantiate these claims. Rather, studies have found that static stretching have failed to relieve DOMS.


McGlynn, GH, Laughlin, NT, Rowe, V. Effect of electromyographic feedback and static stretching on artificially induced muscle soreness. AM j Phys Med 1979: 58(3): 139-148

Numerous athletic teams have noted an increase in musculotendinous injuries after the institution of static stretching programs.

In a meta-analysis studying the effect of static stretching on injury prevention, no definitive conclusions could be drawn as to the value of stretching for reducing the risk of exercise-related injury.

In a meta-analysis studying the effect of static stretching on injury prevention, no definitive conclusions could be drawn as to the value of stretching for reducing the risk of exercise-related injury.


Studies have found that general fitness, rather than flexibility, is important for injury prevention. Overall, the evidence suggests that increasing range of motion beyond function through stretching is not beneficial and can actually cause injury and decrease performance. These findings should be used to challenge common


The basic science literature supports the epidemiologic evidence that stretching before exercise does not reduce the risk of injury.

Shrier I, Stretching before exercise does not reduce the risk of local muscle injury: a critical review of the clinical and basic science literature. Clinical Journal of Sport Medicine, 1999 Oct; 9(4): 221-7

Static stretching or passive flexibility has been shown to have a low level of correlation to level of sports achievement. In fact, static stretching may not only fail to improve performance, but may actually hinder performance. Static stretching has been shown to reduce force generating capability (and jumping ability) for up to two hours.


Power K; Behm D; Cahill F; Carroll M; Young W. An acute bout of static stretching: effects on force and jumping performance. Medicine and Science in Sports and Exercise (MED SCI SPORTS EXERC), 2004 Aug; 36(8): 1389-96

From a biomechanical point of view, stretching the deltoid muscle by 10% seems to result in a significantly more favourable position in case of shoulder elevation suggests that a 10% elongation of the deltoid muscle, the most important shoulder abductor, improves its ability to elevate the arm.

TYPES OF STRETCHING

Static Stretching

Many people use the term "passive stretching" and "static stretching" interchangeably. However, there are a number of people who make a distinction between the two.

According to M. Alter:

Static stretching involves holding a position. That is, you stretch to the farthest point and hold the stretch. Passive stretching is a technique in which you are relaxed and make no contribution to the range of motion. Instead, an external force is created by an outside agent (personal Practitioner), either manually or mechanically. Over the past decades many experts have advocated prolonged stretch up to 60 seconds. For years, this prolonged static stretch technique was the gold standard. Prolonged static stretching actually decreases the blood flow within the tissue creating localized ischemia and lactic acid buildup. This potentiates irritation or injury of local muscular, tendinous, lymphatic as well as neural tissues, similar to the effects and consequences of trauma and overuse syndromes.

Isometric Stretching

Isometric Stretching Isometric stretching is a type of static stretching which involves the resistance of muscle groups through isometric contractions of the stretched muscles. The use of isometric stretching is one of the fastest ways to develop increased static passive flexibility and is much more effective than either passive stretching or active stretching alone. Isometric stretches also help to develop strength in the "tensed" muscles, and seems to decrease the amount of pain usually associated with stretching.

The most common ways to provide the needed resistance for an isometric stretch are to apply resistance manually to one’s own limbs, to have a partner apply the resistance, or to use an apparatus such as a wall (or the floor) to provide resistance. Isometric stretching is not recommended for children and adolescents whose bones are still growing. These people are usually already flexible enough that the strong stretches produced by the isometric contraction have a much higher risk of damaging tendons and connective tissue.

Ballistic Stretching

Ballistic stretching uses the momentum of a moving body or a limb in an attempt to force it beyond its normal range of motion. It was once thought that this type of stretching was not useful and increased one’s risk of injury. While the risk of injury is higher due to its nature, ballistic stretching can increase one’s dynamic flexibility.
**Types of Stretching**

**Active Isolated Stretching (AIS)**

This method, developed by Aaron Mattes, of muscle lengthening and fascial release provides effective dynamic facilitated stretch of major muscle groups, but more importantly functional and physiological restoration of superficial and deep fascial planes. AIS: The Mattes Method, is an effective treatment for deep and superficial fascial release, restoring proper fascial planes for optimal physiologic function. Performing an Active Isolated stretch of no greater than 2.0 seconds allows the target muscle to optimally lengthen without triggering the protective stretch reflex and subsequent reciprocal antagonistic muscle contraction as the isolated muscle achieves a state of relaxation. Maximal beneficial stretch can be accomplished without opposing tension or resulting trauma.

**Dynamic Stretching**

Dynamic stretching involves moving parts of your body and gradually increasing range of motion, speed of movement, or both. Dynamic stretching consists of controlled leg and arm swings that take you to the limits of your functional range of motion. Ballistic stretches involve trying to force a part of the body beyond its range of motion. Dynamic stretching improves dynamic flexibility and is quite useful as part of your warm-up for an active or aerobic workout.

**Proprioceptive Neuromuscular Facilitation (PNF)**

PNF is an acronym for proprioceptive neuromuscular facilitation and was originally developed as a method for rehabilitating stroke victims. NF stretching is currently the fastest and most effective way known to increase static-passive flexibility. PNF refers to any of several post-isometric relaxation stretching techniques in which a muscle group is passively stretched, then contracts isometrically against resistance while in the stretched position, and then is passively stretched again through the resulting increased range of motion. PNF stretching usually employs the use of a partner to provide resistance against the isometric contraction and then later to passively take the joint through its increased range of motion. After contracting isometrically, a muscle will retain its ability to stretch beyond its initial maximum length. As such, PNF tries to take immediate advantage of this increased range of motion by immediately subjecting the contracted muscle to a passive stretch.
The Functional Range of Motion method is an inclusive approach utilizing components of various stretching methodologies: Partner-assisted stretching; PNF; Active Isolated: Mattes Method; as well as sound research; and proper body mechanics.

The principles are as follows:

1. Unless indicated, only muscles that are prone to shortening are stretched. These muscles are classified as tonic or postural. Range of motion tests can be used to determine which muscles are to be stretched.

2. Muscles are to be stretched within the normal range of motion. Stretching a muscle outside its range of motion reduces its protective ability and places the associated connective tissue under unnecessary strain.

3. Neutral spinal posture is a prerequisite for all extremity stretching.

4. During lengthening of the agonist, the client must be instructed to exhale. Exhalation will facilitate contraction of the deeper abdominal muscles, promoting maintenance of normal posture.

5. Each stretch and contraction is held for a count of 2 and 10 seconds respectively, for a total of 5 repetitions.

6. During stretch of the agonist muscle, the antagonist is contracted. Contraction of the agonist develops strength at the client’s new found range of motion, as well reciprocally inhibits the muscle being stretched.

7. The first repetition begins at approximately 75% the individual maximal range of motion (or 75% of normal joint range of motion), and gradually increased.

8. Static stretching is to be done as a recuperative method, either post-workout or on non-training days. Static stretching has been shown to reduce physical performance and increase the risk of injury.

9. Two-joint muscles are to only be stretched at one joint. The range of motion of a two joint muscle is ALWAYS less than the sum of the two joints that it crosses.

10. Muscles are not to be stretched immediately post-injury, unless under the supervision of a qualified health care practitioner. Muscle spasm as a result of any injury serves to protect the joint from real or potential injury.

11. Functional range of motion can only be truly achieved by performing one’s common activities in a full range of motion.
Functional Range of Motion® stretches are based on joint movements, as well as muscle function. Each stretch is described accordingly:

- Client Position (CP)
- Practitioner Position (PP)
- Hand Position (HP)
- Client Instructions (CI)

Joint Classification

Shoulder Girdle
- Protractors
- Elevators

Glenohumeral Joint
- Lateral Rotators
- Medial Rotators
- Flexors

Elbow Joint
- Flexors

Hip Joint
- Flexors
- Adductors

Knee Joint
- Flexors
- Extensors

Ankle Joint
- Plantar Flexors
Finding neutral spine is essential to the increasing the flexibility of the upper and lower extremities. In our quest to increase range of motion, we often sacrifice core stability and strength. Maintaining neutral spine can be challenging for a client with little body awareness. It is, however, simple to teach and involves the use of the deeper abdominal muscles, as well as the outer rectus abdominus and obliques.

**Method One**

1. Using ones hands to form a triangle (with index fingers and thumbs), line ASIS and pubic symphysis in:

   Horizontal plane or, Vertical plane (if standing)

2. Increase curve in lumbar spine.

3. During exhalation:
   - Contract transverse abdominus (abdominal hollowing)
   - Contract pelvic floor muscles (Kegel)
   - Client may have to brace abdominal wall by contracting rectus abdominus in order to prevent movement of pelvis during some movements.
Neutral Spine

Method Two

- Locate the client’s PSIS and ASIS with your index and thumb, respectively.
- Line up the client’s PSIS and ASIS in same horizontal plane.
STRETCHES

Shoulder Girdle

Without proper movement of this joint, the glenohumeral joint cannot move efficiently. The shoulder girdle is the articulation between the scapula and thorax, as well as the glenohumeral joint, previously mentioned. Due to its muscular attachments, the shoulder girdle functions intricately with the vertebral column (neck and thorax). Postural faults, such as rounded shoulders and anterior head carriage, collectively known as upper crossed syndrome, limit the range of motion at this joint. A common fault seen in many gyms is training the muscles of the shoulder girdle as if they were strictly postural. Many of the muscles at this joint, while attached to the spine, function more dynamically than one would think. The most noticeable of these are the rhomboids. The ranges of motion about the shoulder girdle are difficult to quantify, but asymmetries can easily be detected.
SHOULDER GIRDLE

Protractors

Pectoralis Minor

Client Position (CP):
Supine, arms in neutral

Practitioner Position (PP):
Standing, at clients head

Hand Position (HP):
Base of hands on anterior deltoids

Client Instructions (CI):
During inhale, push shoulders into practitioner`s hands
During exhale, relax shoulders and retract shoulder

Click Below To View Video
**SHOULDER GIRDLE**

**Elevators**

**Upper Trapezius**

Client Position (CP):
- Supine, arms in neutral

Practitioner Position (PP):
- Standing, at clients head

Hand Position (HP):
- Base of hands on middle deltoids

Client Instructions (CI):
- During inhale, push shoulders into practitioner`s hands
- During exhale, relax shoulders and depress shoulder blades
- Instruct client to flex cervical spine
- Keep hands on client`s trapezius and not on cervical spine

**Click Below To View Video**
Unlike the hip joint, the GH joint is designed for mobility. There are no ligamentous supports. Rather, the rotator cuff complex (supraspinatus, subscapularis, infraspinatus, and teres minor) assume the supportive role. The movements at this joint are dynamic. A considerable range of motion must be permitted to allow for certain movements. The muscles of the GH joint must not only create movement, but must also, often simultaneously, add stability to an already unstable joint. As such, the incidence of overuse is high. The GH joint is also affected by the position of the thorax and neck, which in turn affects the shoulder girdle. Even dysfunction in the lower limb can create havoc at this delicate joint. The shoulder can abduct and forward flex to 180 degrees. In the absence of dysfunction, the shoulder can rotate medially and laterally up to 90 degrees. Finally, extension and adduction are limited to 60 and 75 degrees, respectively.
**GLENOHUMERAL JOINT**

**Medial Rotators**

**Upper Fibres Pectoralis Major**

Client Position (CP):

Supine or supine, arm at 90 degrees abduction and flexion at GH joint, palm up

Practitioner Position (PP):

Standing, at clients head

Hand Position (HP):

One hand middle deltoid and other on ipsilateral elbow

Client Instructions (CI):

During inhale, push elbow into practitioner’s hands

During exhale, relax elbow and horizontally abduct shoulder

[Click Below To View Video]
**Glenohumeral Joint**

**Medial Rotators**

**Lower Fibres Pectoralis Major**

Client Position (CP):
Supine or seated, arm at 135 degrees abduction and flexion at GH joint, palm up

Practitioner Position (PP):
Standing, at clients head

Hand Position (HP):
One hand middle deltoid and other on ipsilateral elbow

Client Instructions (CI):
During inhale, push elbow into practitioner’s hands
During exhale, relax elbow and horizontally abduct shoulder

**Click Below To View Video**
Glenohumeral Joint

Medial Rotators

Latissimus Dorsi

Client Position (CP):

Seated, arm at 180 degrees abduction and external rotation at GH joint.

Practitioner Position (PP):

Standing, behind client

Hand Position (HP):

One hand opposite deltoid and other on ipsilateral elbow

Client Instructions (CI):

During inhale, push elbow into practitioner’s hands

During exhale, relax elbow and abduct shoulder

As practitioner stretches client, instruct client to remain in neutral and keep hips firmly on bench
ELBOW JOINT

The elbow joint is a complex joint in that it functions closely with the hand and wrist complex. Many authorities consider the elbow to move through only flexion and extension and consider supination and pronation to occur only at the wrist. This is misleading as supination also occurs at the elbow joint, or more specifically, at the proximal radio-ulnar joint. For the purposes of this course, only flexion and extension will be considered. Elbow extension can reach up to 10 degrees, especially in those with ligament laxity. Flexion is limited by the soft-tissues of the arm (biceps and forearm flexors) to approximately 135 degrees.
ELBOW JOINT

Flexors

Biceps Brachii

Client Position (CP):
Seated, arm in neutral, and elbow flexed to 90 degrees

Practitioner Position (PP):
Standing, behind client

Hand Position (HP):
One hand on trapezius and other on ipsilateral elbow

Client Instructions (CI):
During inhale, push elbow into Practitioner’s hands
During exhale, extend arm at GH joint
A common error when training the hip joint is the overemphasis on range of motion. Unlike many other joints, the hip is tightly bound by strong ligaments, checking its motion, especially in extension. The function of the muscles, on the other hand, is to steady the hip during weight-bearing, gait, and other functional activities. Unlike the shoulder, the main function of the hip is to provide stability.

Despite having limited ranges of motion (except for flexion), the hip has three degrees of freedom. That is, it can flex and extend; abduct and adduct, and rotate medially and laterally. Depending on the activity, the movement often involves a combination of these. The interesting thing about the muscles that surround the hip, is that their function may change depending on position of the hip. To describe each of these exceptions is beyond the scope of this course.

The range of motion at the hip in flexion and extension is 135 degrees and 30 degrees, respectively. However, with the knee extended, as in a straight leg raise or hurdler’s stretch, the range is reduced to between 90 and 120 degrees (sources vary). Extreme caution must be used when stretching clients beyond these ranges as injuries can result.

The range of motion in adduction and abduction are both 20-30 degrees. Medial and lateral rotation are checked by the ligaments at 45 and 60, respectively.
HIP JOINT

Flexors

Iliopsoas (Rectus Femoris)

Client Position (CP):
Supine, opposite knee to chest

Practitioner Position (PP):
Standing or kneeling, at client’s feet

Hand Position (HP):
One hand on quadriceps and other on opposite knee

Client Instructions (CI):
During inhale, flex hip into practitioner’s hand
During exhale, relax hip flexion and contract ipsilateral gluteus maximus

Click Below To View Video
HIP JOINT

Adductors

Adductor Group

Client Position (CP): Supine, hips and knees in neutral
Practitioner Position (PP): Standing or kneeling, at client’s feet
Hand Position (HP): One hand on inner thigh (above knee) and other on opposite ASIS
Client Instructions (CI): During inhale, adduct thigh into Practitioner’s hand
During exhale, relax thigh adduction and contract ipsilateral gluteus medius

Click Below To View Video
For such a complex joint, the knee can only flex and extend. There is minimal rotation at this joint, but it is involuntary. The rotation of the lower limb occurs at the hip and at the ankle-foot complex. Since the knee is surrounded by the powerful quadriceps and hamstrings, the ligamentous structure must be very strong to withstand the resultant stresses. Various ligaments check rotation and others increase the congruity of the joint in order to ensure safe and efficient movement.

With the ankle and hip in neutral, the range of motion in knee extension and flexion are 15 and 135 degrees.

Many of the muscles that act on the knee have their origins at the hip joint. As such, the two joints are often related in many functional activities.
**KNEE JOINT**

**Extensors**

**Quadriceps**

Client Position (CP): Supine, opposite knee and hip flexed to 45 degrees

Practitioner Position (PP): Standing or kneeling, at client’s feet

Hand Position (HP): One hand on shin and other on opposite knee

Client Instructions (CI): During inhale, extend shin into practitioner’s hand; during exhale, relax knee extension and contract hamstrings

[Click Below To View Video]
Client Position (CP):

Supine, knee straight and hip flexed; opposite knee and hip flexed to 45 degrees

Practitioner Position (PP):

Standing, at client’s feet

Hand Position (HP):

One hand on calf and other on quadriceps, just above knee

Client Instructions (CI):

During inhale, push thigh (via hip extension) into practitioner’s hand

During exhale, contract hip flexors, pulling thigh towards pelvis

Click Below To View Video
The ankle joint, along with the other joints of the foot, have two mutually exclusive functions: stability and mobility. This ankle-foot complex, must adapt to uneven terrain and dissipate the forces of gait, while providing a rigid lever for toe-off and other weight-bearing activities.

The movements at the ankle-foot complex are actually a combination of various joint rotations. The details of these, however, are beyond the scope of this course. Rather, the movements that are caused by the muscles that cross the ankle joint, will be discussed. These are principally plantarflexion, dorsiflexion, inversion, and eversion. With the knee extended, the range of motion for plantarflexion and dorsiflexion are 50 and 20, respectively. With the knee flexion, the range of motion in dorsiflexion increases slightly due to the reduced strain on the gastrocnemius muscle. Extreme dorsiflexion is limited by the contact of the talus with the distal tibio-fibular joint. In some pathological conditions, such as subluxation of the talus, the range of dorsiflexion is reduced prematurely. Stretching the plantarflexion in this instance is not indicated. Rather, joint mobilizations and/or adjustments are required.
**ANKLE**

**Plantarflexors**

**Gastrocnemius**

Client Position (CP):

Practitioner Position (PP):

Hand Position (HP):

Client Instructions (CI):

Supine, knee straight and hip flexed; opposite knee and hip straightened

Standing, at client’s feet

One hand on Achilles tendon, other on ball of foot

During inhale, plantarflex into practitioner’s hand.

During exhale, relax and dorsiflex ankle

**Click Below To View Video**
**ANKLE**

**Plantarflexors**

**Soleus**

Client Position (CP):

Practitioner Position (PP):

Hand Position (HP):

Client Instructions (CI):

Supine, knee flexed and hip flexed; opposite knee and hip in neutral

Standing, at client’s feet

One hand on Achilles tendon, other on ball of foot

During inhale, plantarflex into practitioner’s hand

During exhale, relax and dorsiflex ankle

*Click Below To View Video*
Client supine

Place the client’s arm in neutral, with the elbow extended

Observe the position of the client’s shoulders

Click Below To View Video
Pectoralis Major (Upper Fibres)

Client supine

Place the client’s arm in 90 degrees or 135 degrees for upper (clavicular) and lower (sternal) portion, respectively

Exert a downward pressure above the client’s elbow and observe position of arm relative to the ground.
APPENDIX A: LENGTH TESTING FOR TONIC MUSCLES

Pectoralis Major (Lower Fibres)

Client supine

Place the client’s arm in 90 degrees or 135 degrees for upper (clavicular) and lower (sternal) portion, respectively.

Exert a downward pressure above the client’s elbow and observe position of arm relative to the ground.

Click Below To View Video
APPENDIX A: LENGTH TESTING FOR TONIC MUSCLES

Latissimus Dorsi

Client supine

Place both arms in 180 degrees flexion (or abduction)

Exert a downward pressure above the client’s elbow and observe position of arm relative to the ground, as well as the lumbar spine

Click Below To View Video
Hamstrings

Client supine with sacrum and lumbar spine flat on the table or floor

Extend the client’s knee and position the ankle in neutral and passively force the client’s hip into flexion

Note the position of the limb when the lumbar spine rises from the table or floor
APPENDIX A: LENGTH TESTING FOR TONIC MUSCLES

Iliopsoas (Rectus Femoris)

Client supine

Instruct the client to flex both knees and hips maximally

Instruct the client to then straighten out one leg at both the hips and knees

Click Below To View Video
APPENDIX A: LENGTH TESTING FOR TONIC MUSCLES

Quadriceps

Client prone

Position the pelvis in neutral and flex the client’s knee

Click Below To View Video
Gastrocnemius

Client prone with knee in full extension and foot relaxed

Stand at the feet of the client with testing hand placed on the ball of the foot being tested

Passively force the client’s foot into dorsiflexion
Soleus

Client prone with knee in flexion and foot relaxed

Stand at the feet of the client with testing hand placed on the ball of the foot being tested

Passively force the client’s foot into dorsiflexion
## APPENDIX B: NORMAL RANGE OF MOTION

<table>
<thead>
<tr>
<th></th>
<th>Flexion</th>
<th>Extension</th>
<th>Abduction</th>
<th>Adduction</th>
<th>External Rotation</th>
<th>Internal Rotation</th>
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<tbody>
<tr>
<td>Shoulder Girdle</td>
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<td>NA</td>
<td>NA</td>
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<td>Glenohumeral</td>
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<td>Knee</td>
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<td>15</td>
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