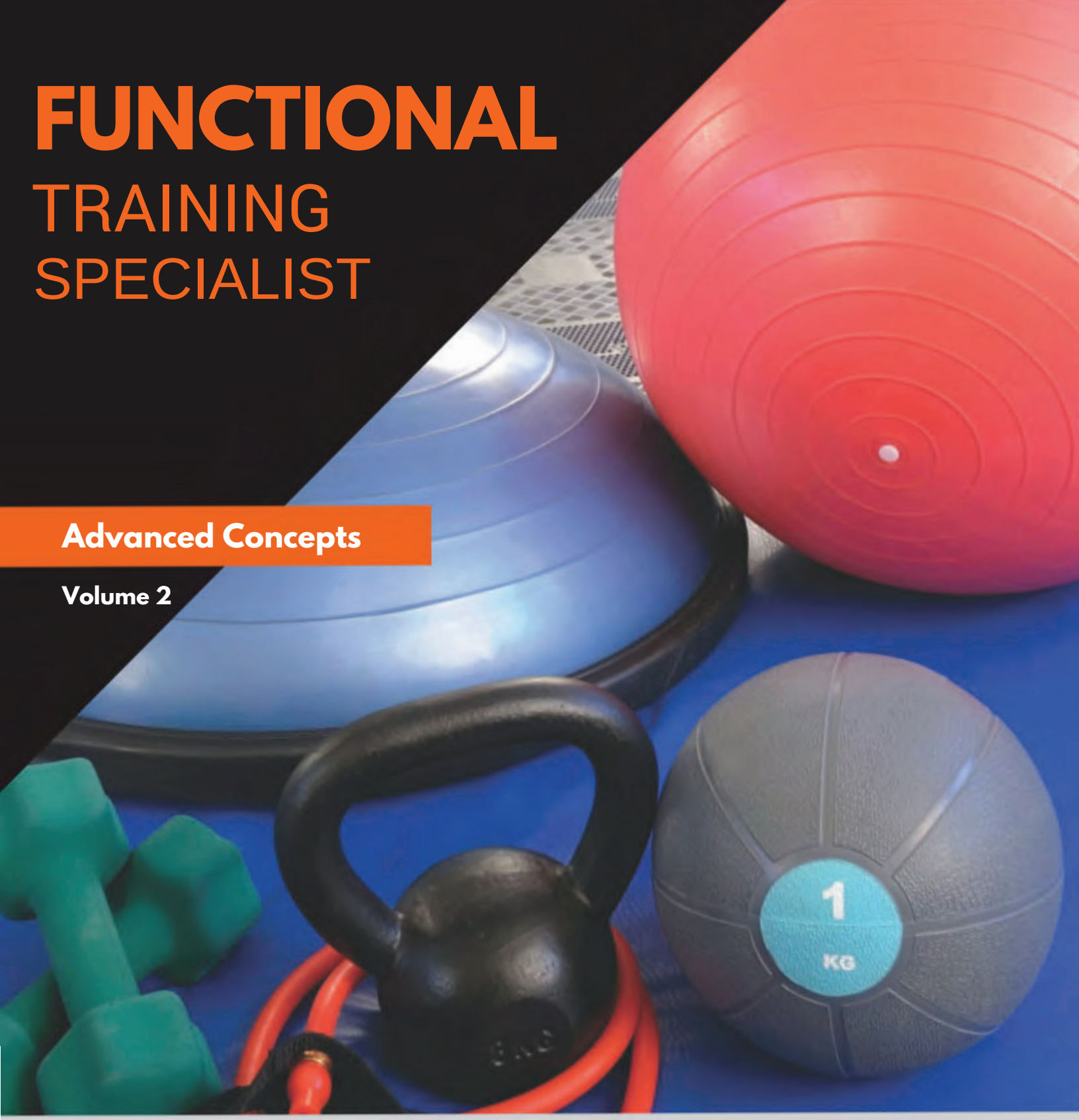
FUNCTIONAL TRAINING SPECIALIST

Advanced Concepts

Volume 2



NFPT

Understanding the Importance of Functional Exercise and its Application for Each Individual Client.

Principles of Functional Exercise

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CHAPTER 1

What is Functional Training?

What is Functional Training?

Today there are so many different opinions on how one should exercise. "What type of training is the best?" is the big question. "Does one perform slow or fast reps? Is a bench or a physio-ball better? One body part at a time or full body?" The answer is that everyone should be training in a manner that relates to their individual goals. There is no set routine that equally benefits everyone who does it. Performing a typical gym program of random exercises, three sets of ten, with one minute rests has benefits but will not be the most efficient way to attain your goals or address your specific needs. Training primarily with machines and not using free weights is inefficient because you are moving resistance along a fixed axis, not freely in space as the body normally functions. Machines have limited functional strength transfer to real life situations in most cases, and can actually create poor motor patterns in some people. Machines have value when integrated properly but are often misused.

Functional training is defined as movements or exercises that improve a person's ability to complete their daily activities or to achieve a specific goal. It is not a series of exercises deemed functional by some manual. Doing movements in the gym that strengthen the muscles involved in the movements you wish to improve outside the gym is a good start. This does not mean you can simply add weight to the exact movement you wish to enhance. There is research that has proven doing this can actually be detrimental to some athletic movements. When a baseball player adds weight to his bat that can actually slow his bat speed down because the added resistance changes the forces on the joint and disrupts mechanics. All exercises have some functional value when applied correctly, this value is determined by the exercises transferable benefit outside the gym. Every exercise has a functional limitation and it is up to the trainer to understand what it is. A quality program focuses on weak areas and sets specific goals for the client. It is important to understand how to progress someone from simple smaller targeted movements to more complex multi joint movements. Training someone functionally can range from having a tennis player lunge to a chop or a body builder do a slow curl for bigger biceps; its all about the goal. Keep in mind performing complex movements before the client is ready will do more harm than good.

In order to build appropriate muscle strength, joint integrity, balance and flexibility in all planes of motion it is essential that the body is exercised in a functional manner. It is crucial to include multi-joint and multi-planar exercises, as this recruits the body's stabilizers to synergistically facilitate movement. Doing this ensures that the nervous system is working properly and that all parts of the body are used in the appropriate manner, with the correct muscles firing at the right time. This is not to say you shouldn't include some so called non functional exercises, including a machine or old school exercise can be beneficial, safe and fun when applied correctly. To create a functional program, a trainer must set realistic goals and understand the client's weaknesses, daily activities and limitations.

A trainer must be able to identify postural distortions and include exercises that correct them. The trainer must put emphasis on educating the client on what movements or activities to avoid or modify during their day. It's not what you do; it's how you do it. The ability to identify a postural distortion is dependent on the trainer's understanding of anatomy, motor patterns and muscle function. A trainer must also be able to identify when muscles are over active and firing out of sequence, or not firing at all. Synergistic dominance is common in most postural dysfunctions.

In general, if the agonist is tight then the antagonist is weak, thus creating increased stress on the joint. This can result in patterns of repetitive stress, ultimately leading to accelerated joint degeneration.

Core stability, flexibility and balance are key factors when designing a functional exercise routine. It is important to maintain posture while being able to move all joints in a full range of motion. Training with free weights, and challenging the surrounding environment promotes balance and stability, which is necessary if you expect to see benefits outside of the gym. Keep in mind, it is more important to be able to control your own body weight and concentrate on form, balance and core endurance, than to move heavy weights.

A functional core routine consists of dynamic movements, isometric exercises and challenges the center of gravity. To completely train the core, you must also include dynamic stabilization, isometric and proprioceptive movements, not just for the mid section, but for the entire trunk. Medicine balls, balance boards, foam rollers and physio-balls are great tools for core training, and should be integrated into your programs but not over done. As a person ages, balance and stability become compromised. If balance and stability are not addressed, they will consistently degrade. A weak core contributes to poor stability, and inhibits proper limb movements, causing muscle imbalances in the kinetic chain. This is why falls are common in the geriatric population. Many back and hip injuries are related to weak core muscles. There are many small muscles in the core that the general population knows little about or addresses during exercise. In most spinal injuries, MRI images show atrophy in these small muscles. In order to maintain a healthy spine, these little muscles need to be trained. Without stability, even the strongest person can not effectively propel a force into the environment.

Flexibility is a very important facet of any exercise program, but is often over looked. Lack of flexibility in the right places appears to be the root of many problems. The body's movements are hampered when flexibility and posture are distorted. Active, dynamic, static and PNF stretching are key factors and should all be included in any training program. When a muscle is tight, it limits the muscle's ability to contract properly, causing inefficient movements and risk of injury. Without flexibility, the body's movement becomes limited, and good results are difficult to achieve.

This has explained the key components of a functional program and its benefits. Before initiating any exercise program, one should always consult a physician, as well as a qualified fitness professional. This ensures that they are addressing their specific needs and goals.

Pain Related to Daily Activities?

Our daily activities can actually cause muscle imbalances. No matter what your line of work, you probably have some type of routine consisting of repetitive activities. This can overwork some muscles and under-work others. This is one reason why many people often say, "I do not know how this happened – one day I felt pain, but I've never had an injury." The body is a balanced system of levers, and disrupting that balance can put joints at a mechanical disadvantage, causing unnatural and inefficient movements. The muscles that work harder tighten, while the opposite weaker muscles lengthen, causing impingement of joint spaces and other joint irregularities. This

extra wear on the joints and ligaments can also cause arthritis, bulging disks and even tiny fractures in the spine. For example, an office worker who sits incorrectly all day with chin forward, shoulders rounded and leaning over toward the computer will likely have anterior shoulder, low back and neck pain. Think about the amount of times you get up and down in one day. If you are doing so incorrectly, the force on your spine eventually will cause some type of break down. This postural distortion can cause all sorts of problems, such as pain, poor sleep, scar tissue build up and muscle atrophy, just to name a few. Simply taking medication for pain is not enough and routine, impersonal, everyday exercises do not work.

Unfortunately, medication can often be a mask that only exaggerates the problem and introduces new side effects. A general exercise routine doesn't fit every person because people have varying lifestyles and do different things. One person may have back pain due to a hip dysfunction, while another may have a thoracic issue; therefore, exercises need to be tailored to the individual. An effective exercise prescription needs to, not only consider your job, but your daily activities and workout routine. Did you know that stretching alone can alleviate many basic everyday complaints? Exercise and stretching related to daily activities can benefit any person because if you feel better at work, you will perform better. If a job is stressful it can actually cause tension in the neck and back, and pain from tight muscles can trigger stress and thus, the start of a cycle.

A functional program that considers these issues will definitely help your client. Take into consideration what they do all day, and include exercises to offset those repetitive motions or positions. It is not all about big muscles. Help your clients to feel better and they will value your service.

Frequently Asked Questions

Q) Should I do slow or fast repetitions?

A) The speed of the repetitions should be based on the speed of the required activity. The body needs to be trained at the same, or a higher velocity during exercise to benefit a particular activity. A sprinter doesn't jog to increase their speed. Slow training is good for form training, rehabilitation and hypertrophy.

Q) My friend works out at the local gym and mostly uses machines. He has been doing the same routine forever and has had good results. Is this program good for me?

A) NO! If you stick to it, any exercise program will produce results whether it is done right or wrong. Unfortunately when exercise is done incorrectly, the harmful effects may not be noticed until the damage is done. By exercising functionally, you will systematically attain your goals and insure that your time in the gym is spent safely and efficiently. Just because someone looks good does not mean they are an expert.

Q) Can functional training benefit anyone?

A) Yes. Functional workouts are beneficial for any athletic level or age group. When you train in this fashion, you will see drastic improvement in overall health and performance not just appearance.

Q) Shouldn't I do cardio and lose weight before I start a functional program?

A) NO!
You should have a functional training program that concentrates on raising and lowering your heart rate. The program should first use body weight exercises, then advance to free weights. This promotes lean muscle mass, skeletal integrity, and healthy cardiac function. Muscle mass accelerates fat loss.

Q) My friend tells me to do three to five sets of 10-12 repetitions to failure, with one minute rest intervals.

A) This is what everyone who thinks of the gym envisions. This is not a good program unless you are a body builder. If you train in a functional fashion you burn more calories and get more benefit from your sessions outside of the gym.

Q) Aren't aerobic classes and the treadmill enough?

A) NO! A weight training program that includes balance, core stability strength and cardiac conditioning builds lean muscle mass. When you build muscle, you burn more calories at rest and during your daily activities. Therefore, by adding resistance to your program, you will actually will burn more calories doing the same aerobic class or distance on the treadmill.

Q) Should I stretch before or after exercise or an event?

A) Evidence demonstrates that static stretching before an activity is not beneficial to prevent injury. If you want to avoid injury you need to be flexible by doing regular stretching – not just before activity. Active and dynamic stretches, with a short warm up mimicking the activity before, with PNF and static stretching at the end help remove waste from the muscles.

Q) Why have none of my doctors told me to stretch and exercise to alleviate pain?

A) Unfortunately we live in a society where some doctors prescribe medications for everything imaginable. Everyone wants immediate gratification (a pill) not a long term solution (exercise). The fact is most people ignore the doctors' requests to stretch and exercise. Most minor health problems can be eliminated by moderate exercising but people choose to take medications because it is easier.

Q) I injured my knee and my doctor told me to rest it for a while. Do I?

A) So long as the joint is stable, this is the worst thing you can do. Pampering a stable injury for extended periods causes muscle atrophy and decreased blood flow. All injuries should be functionally rehabilitated under careful supervision by a health professional. There are doctors that base their whole practice on movement therapies for injuries, find them. Keep in mind there are injuries that rest is the only answer.

Q) Should I cut carbohydrates out of my diet?

A) NO! Only cut out high, glycemic carbohydrates. Carbohydrates are essential for cellular function. Eating carbohydrates that do not spike insulin levels is healthy and effective for weight loss.

Q) My doctor told me to walk to get some exercise for my aches. Is walking enough?

A) NO WAY! If walking were enough, everyone would be healthy as we all walk. If you have pain chances are there is a biomechanical issue. My first suggestion would be to stretch. More walking may further aggravate the issue; you need to correct the imbalance first, not just walk more. I suggest seeing a Physical Therapist for this situation if stretching doesn't help.

CHAPTER 1

1. You should mostly _____ when designing your program.
    A. Use machines
    B. Use free weights
    C. Focus on goal oriented exercises
    D. None of the above

2. You should train athletes based on movements performed in the sport only?
    A. True
    B. False

3. If a person has a very weak core in most cases it will create a postural distortion?
    A. True
    B. False

4. Flexibility is an important part of every program?
    A. True
    B. False

5. You should take into account what your client does all day long when designing their program?
    A. True
    B. False

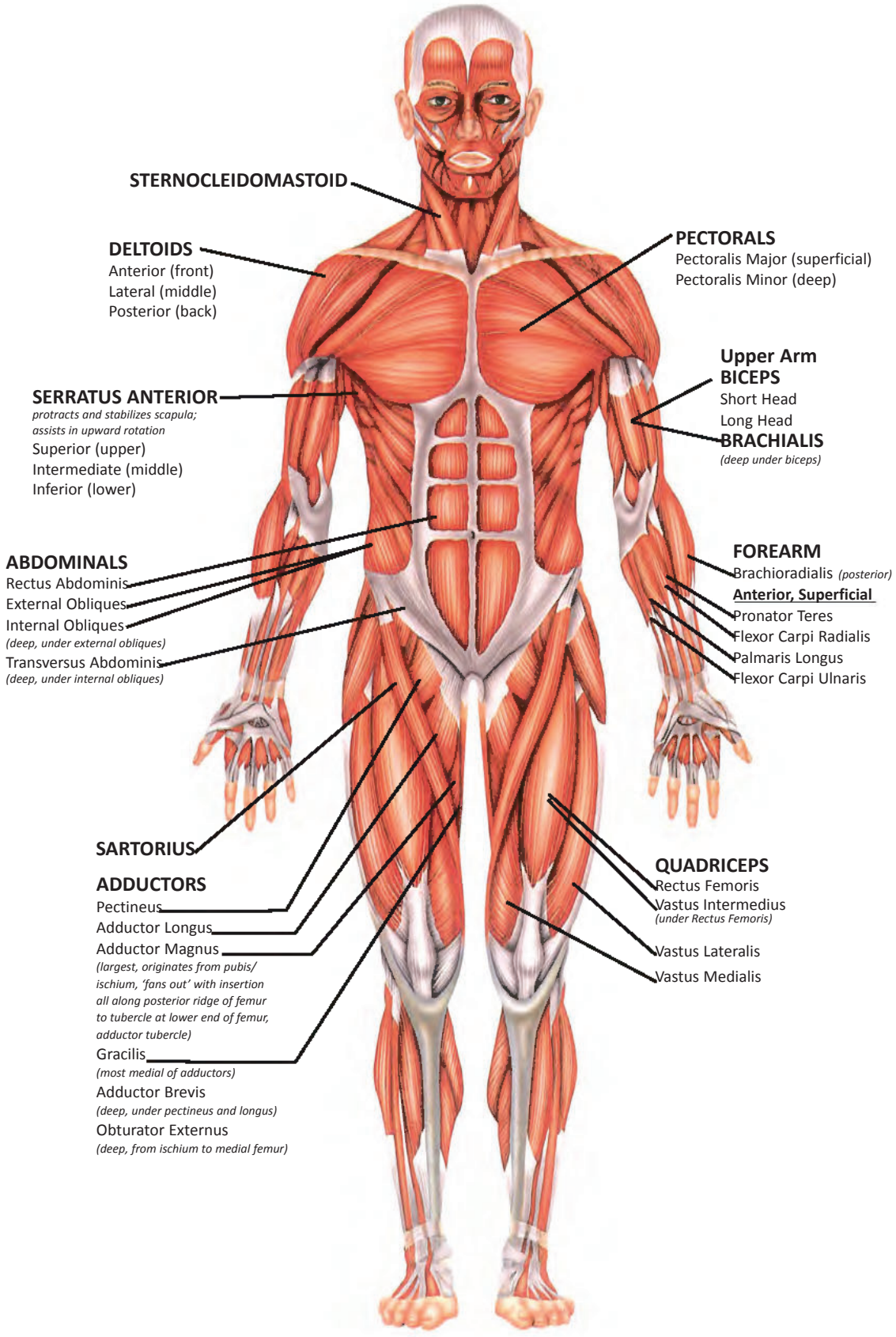
6. For a program to be considered functional it must be
    A. Goal oriented
    B. Relate to each client's needs
    C. Target faulty movements patterns
    D. All of the above

CHAPTER 2

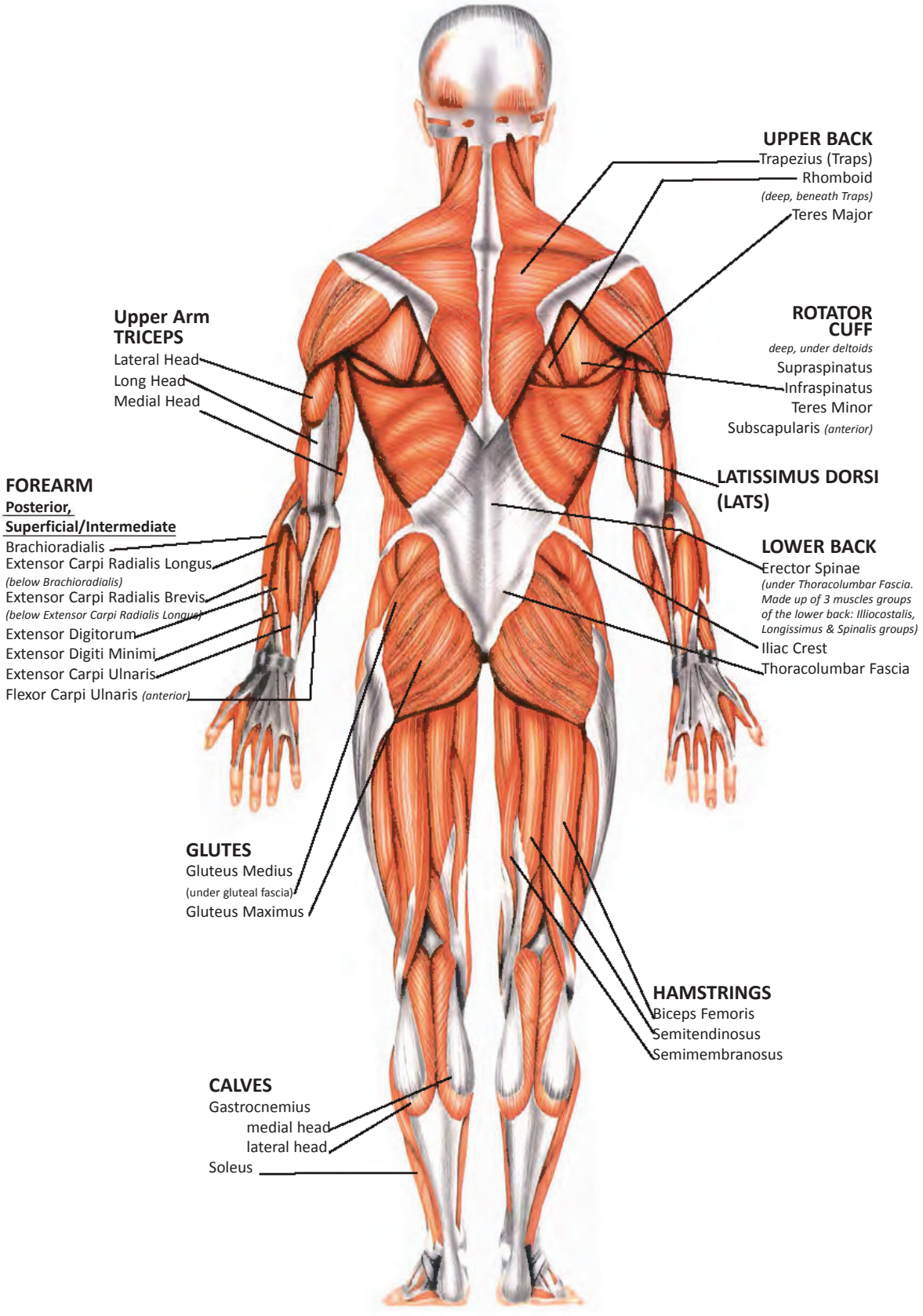
Anatomy

This section is only meant as a quick anatomy reference.
We suggest Kinetic Anatomy by Robert S. Behnke
Strength Training Anatomy by Frederick Delavier
or online winkingskull.com

ANTERIOR VIEW: major muscles



POSTERIOR VIEW: major muscles



Biomechanical Movement

- Flexion - bending of a joint that decreases the angle.
- Extension - straightening of a joint that increases the angle.
- Hypoextension - less extension than normal.
- Hyperextension - extension beyond normal limits.
- Abduction - away from the body.
- Adduction - toward the body.
- Pronation - palm turning down.
- Supination - palm turning up.
- Rotation - around an axis.
- Circumduction - circular movement.
- Protraction - forward motion, occurs at glenohumeral joint.
- Retraction - backward motion, occurs in the glenohumeral joint.
- Internal rotation - while rotating on its own long axis, the anterior surface moves towards the midline.
- External rotation - while rotating on its own long axis, the anterior surface moves away from the midline.
- Elevation - moving or lifting and body part in a superior direction.
- Depression - moving a body part in an inferior direction.
- Dorsiflexion - (ankle) pointing foot up towards body.
- Plantarflexion - (ankle) pointing foot down.
- Inversion - turning feet inward so the soles face each other.
- Eversion - turning the soles outward.
- Gliding - movement of non-angular joints over each other.
- Deviation - departure from the midline.

CHEST

Pectoralis Major (Clavicular)

Joint Action of the Shoulder (glenohumeral)

1. Horizontal adduction
2. Internal Rotation
3. Adduction
4. Flexion
5. Abduction

Example – Brings the arm across the body. Pushes forward (Protraction)

Origin – Clavicle (Anterior) at the medial half

Insertion – Humerus (Proximal and Anterior) located within the intertubercular groove

Sports associated with these movements include gymnastics and swimming

Weight training movements include but are not limited to Chest press, dumbbell flies, Lat. Pulldowns

Common distortions due to tightness include an internally rotated humerus contributing to scapular fixation while abducting.

PECTORALIS MINOR

Joint action of the Scapula

1. Abduction
2. Downward rotation (during abduction)
3. Depression

Joint Action of the Ribs

1. Elevation.

For example it pulls coracoid process of scapula inferiorly.

Origin – Ribs (3rd to 5th Vertebrae) along the anterior surface

Insertion – Scapula (superior anterior) attaches to coracoid process (medial border)

Sports associated with these movements are climbing and gymnastics

Weight training exercises commonly associated are dips and Lat. Pulldowns.

Common distortions caused by tightness include a scapula that is abducted, depressed, and protracted. The combination of these three may cause impingement of the brachial plexus and axillary artery, resulting in negative arm and hand symptoms

STERNAL

Joint Action of the Shoulder (glenohumeral)

1. Horizontal Adduction
2. Internal Rotation
3. Adduction
4. Extension

Joint Action of the Scapula (assisting the shoulder)

1. Downward rotation
2. Depression
3. Abduction (Initially)

An example of the scapula assisting the shoulder in its movement pattern is pulling of the arm from above the head down to a horizontal position.

Origin – Sternum (Anteriorly) located between the 2nd and 6th Rib vertebrae. It is comprised of Costal cartilage.

Insertion – Humerus (proximal anterior) is located within the Intertubercular groove.

Common distortions caused by tightness assists in the development of an internally rotated humerus which is a primary contributing factor to scapular depression.

SERRATUS ANTERIOR

Joint Action of the Scapula

1. Protraction
2. Abduction
3. Scapular stabilizer (fastens medial border to rib cage)

Origin – Rib surface located at upper 8th or 9th vertebrae

Insertion – Scapula at the anterior surface and medial border.

Common distortions caused by weakness are winging of medial border of scapula and shortness of the rhomboid muscles.

BACK

Latissimus Dorsi

Joint Action performed by the Shoulder (glenohumeral)

1. Adduction
2. Extension
3. Internal Rotation
4. Horizontal Abduction

Joint Action performed by the Scapula (assists)

1. Depression
2. Downward rotation
3. Adduction

Joint Action performed by Trunk

1. Unilaterally: Laterally flexes trunk
2. Bilaterally: anteriorly tilts pelvis

For example the pulling down of your arm from above your head brings the shoulder blades (scapular) together. The ability to pull the body up and forward when hanging from the arms is also an example.

Origin:
1. Ilium
2. Posterior crest
3. Sacrum (posterior)
4. Vertebral Column (lateral surface): Lumbar Vertebrae (L1-5), Thoracic vertebrae (T7-12), Ribs (posterior, Lower 3 or 4 ribs)

Insertion : Humerus (proximal anterior/medial)

1. Intertubercular groove

Sports associated with but limited to major contribution of your back are gymnastics, swimming, climbing, Weight training – chin ups, Lat. Pulldowns.

Common Distortions caused by tightness is an Internally rotated humerus, Protracted scapula, and Lumbar hyperextension

TERES MAJOR

Joint Action performed by the Shoulder (glenohumeral)

1. Internal Rotation
2. Extension
3. Adduction

An example would be assisting in drawing the arm back and inward.

Origin: 1. Scapula (posterior, inferior)
2. Inferior angle (posterior, lateral)

Insertion: Humerus (proximal anterior/medial)

1. Intertubercular groove

Sports associtated but not limited to the use of the Teres Major are rowing, cross country skiing. Weight training – seated row, Lat. Pulldown

Common Distortions caused by tightness is a laterally rotated scapula

TRAPEZIUS (LOWER FIBERS)

Joint Action perfomed by the scapula (scapular stabilizer)

1. Upper rotation
2. Adduction
3. Depression

Joint Action performed by Thoracic Spine

1. Extension

Origin: Spine – 1. Thoracic Vertebrae (T4-12) – Spinous Processes

Inserstion: 1. Scapula – Spine (inferior)

TRAPEZIUS (MIDDLE FIBERS)

Joint Action performed by the scapula

1. Retraction (adduction)
2. Elevation
3. Upward Rotation

For example the squeezing together of the scapulars acts as a scapular stabilizer

Origin: 1. Cervical vertebrae (C7) – Spinous Process 2. Thoracic vertebrae (T1-T3) – Spinous Processes

Insertion: 1. Scapula – Acromion process, Spine (superior)

Common distortions due to weakness is scapular protraction and elevation (this contributes to poor glenohumeral mechanics and rotator cuff dysfunction)

TRAPEZIUS (UPPER FIBERS)

Joint Action of the scapula

1. Elevation

Joint Action of the Spine (cervical)

1. Extension
2. Lateral flexion
3. Contralateral rotation

The joint actions of the scapula and spine contribute to the ability of the head to rotation laterally as well as flex forward and extend back.

Origin: Skull (posterior inferior)

1. Superior nuchal line (medial third)
2. Occipital protuberance (external)
3. Ligamentum nuchae (posterior neck ligaments)

Insertion: Clavicle – Lateral third (posterior)

Common distortions due to tightness: 1. Elevated shoulder gurdle 2.Early activation during humeral abduction (this contributes to poor glenohumeral mechanics and rotator cuff dysfunction.) This muscle is often overworked in weight training programs with exercises such as shrugs. It is important that the middle and lower fibers are worked equally, if not more, in order to establish scapular stabilization.

LEVATOR SCAPULAE

Joint Action performed by the scapula

1. Elevation
2. Downward rotation
3. Abduction

Joint Action performed by the Cervical spine

1. Lateral flexion to the same side
2. Right rotation (right levator scapulae)
3. Left rotation (Left levator scapulae)

For example when carrying a weight the Trapezius stabilizes the scapula

Origin: Cervical Vertebrae (upper C3 or 4) – Transverse Process

Insertion: Scapula – Medial border (superior angle)

Common distortions caused by tightness: 1. Elevated shoulder girdle
2. Over-worked with Upper Trapezius

RHOMBOID MAJOR

Joint Action performed by the scapula

1. Adduction
2. Downward rotation

For example it assists the trapezius when moving upper extremity to stabilize scapula

Origin: Thoracic Vertebrae (T2-T5) – Spinous Process

Insertion: Scapula – Medial border (below spine)

Common distortions due to tightness is a protracted Scapula

RHOMBOID MINOR

Joint Action performed by the scapula

1. Adduction
2. Downward rotation

For example it assists the middle trapezius when moving upper extremity to stabilize scapula

Origin: 1. Cervical Vertebrae (C7) – Spinous Processes
2. Thoracic Vertebrae (T1) – Spinous Processes

Insertion: Scapula – Medial Border (at level of the spine)

Common distortions caused by weakness is a protracted scapula

Erector Spinae

I. Iliocostalis – 1. Lumborum 2. Thoracis 3. Cervicis
II. Longissiums – 1. Thoracis 2. Cervicis 3. Capitis
III. Spinalis – 1. Thoracis 2. Cervicis 3. Capitis

Joint Action performed by Lumbar/Thoracic Spine

1. Extension (I,II,III)
2. Lateral flexion (I)
3. Rotation (I)

Joint Action performed by Cervical spine

1. Extension (I,II,III)
2. Lateral flexion (I,II)
3. Rotation (I,II)

Joint Action performed by Upper cervical (Atlantoccipital & Atlantoaxial)

1. Extension – Both sides (II,III)
2. Rotation – A. Rotation right (right II, III) B. Rotation left (Left II, III)
3. Lateral Flexion – A. Lateral flexion right (right II,III) B. Lateral Flexion left (left II,III)

Origin: 1. Sacrum – Posterior surface (I)
2. Ribs – posterior (I)
3. Lumbar vertebrae (Transverse process (II)
4. Thoracic vertebrae - Transverse processes (II, III)
5. Cervical vertebrae – Transverse Processes (III)
6. Ligamentum Nuchae (III)

Insertion: Ribs – 1. Posterior (I)
2. Cervical vertebrae – A. Transverse processes (I,II) B. Spinous processes (III)
3. Thoracic vertebrae – A. Transverse processes (II) B. Spinous Processes (III)
4. Skull – A. Mastoid Processes (II) B. Occipital bone (III)

Common distortions caused by tightness are hyperextensions of the back and neck vertebrae.

SHOULDER

Anterior Deltoid

Joint Action performed by the Shoulder (glenohumeral)

1. Abduction
2. Flexion
3. Horizontal Abduction
4. Internal Rotation

For exampke the anterior deltoid allows the raising your arm in front of you (flexion)

Origin: Clavicle – anterior lateral third

Insertion: Humerus (lateral) - Deltoid tuberosity
Common distortions caused by tightness is an internally rotated humerus

MIDDLE DELTOID

Joint Action performed by the Shoulder (glenohumeral)

1. Abduction
2. Horizontal Abduction
3. Flexion

For example it allows the raising of the arm out to the side.

Origin: Scapula – Acromion (lateral)

Insertion: Humerus (lateral – Deltoid tuberosity

POSTERIOR DELTOID

Joint Action performed by the Shoulder (glenohumeral)

1. Extension
2. Horizontal Abduction
3. External Rotation

For example it allows for the arm to be raised to the back

Origin: Scapula – spine (inferior edge)

Insertion: Humerus (lateral) – Deltoid tuberosity

Common distortions caused by tightness (all fibers) is an elevated humerus and the weakening of the supraspinatus and impingement of the supraspinatus tendon.

ROTATOR CUFF

Infraspinatus

Joint Action performed by the Shoulder (glenohumeral)

1. External Rotation
2. Horizontal Abduction
3. Stabilizes glenohumeral joint

For example performing external rotation in a side-lying position.

Origin: Scapula – Infraspinous fossa (medial)

Insertion: Humerus – Greater tubercle (posterior)

Common distortions caused by weakness are an internally rotated humerus, tennis elbow (increased use of wrist extensors to compensate for lack of external glenohumeral rotation), and Glenohumeral instability

SUPRASPINATUS

Joint Action performed by the Shoulder (glenohumeral)

1. Abduction (initiates)
2. Stabilizes glenohumeral joint

For example performing shoulder abduction in a side-lying position.

Origin: Scapula – superior

Insertion: Humerus – 1. Greater tubercle (superior)
2. Superior facet

Common distortions caused by weakness is an over activation of the deltoid and glenohumeral instability.

SUBSCAPULARIS

Joint Action performed by the Shoulder (glenohumeral)

1. Internal Rotation
2. Stabilizes glenohumeral joint
3. Acts as a decelerator of glenohumeral joint when externally rotating

For example it decelerates glenohumeral joint during the cocking phase of overhand throwing. As well as performing internal rotation in the side-lying position.

Origin: Scapula (anterior) – Subscapularis fossa
Insertion: Humerus (proximal anterior) Lesser tubercle

Common distortions due to weakness include glenohumeral instability and the inability to reach behind the back

Common distortions due to tightness is an internally rotated humerus.

TERES MINOR

Joint Action performed by the Shoulder (glenohumeral)

1. External Rotation
2. Horizontal abduction
3. Stabilizes glenohumeral joint

Origin: Scapula – Lateral border, Posterior on upper and middle aspect

Insertion: Humerus – Greater tubercle (posterior) – inferior facet

Common distortions caused by weakness is glenohumeral instability

ARM

Biceps Brachii (long head)

Joint Action performed by the Elbow and Forearm

1. Flexion
2. Supination - respectively

For example it bends the elbow and turns palms up.

Origin: Scapula – Supraglenoid tubercle

Insertion: 1. Radius – Tubercle
2. Fascia of forearm – Bicipital aponeurosis

The bicep tendon also assists in glenohumeral stabilization

Common exercises include bicep curls, Lat. Pulldowns.

Biceps Brachii (short head)

Joint Action performed by the Elbow, Forearm

1. Flexion
2. Supination – respectively

Joint Action performed by the Shoulder (glenohumeral)

1. Flexion (weak)
2. Horizontal Abduction (weak)

For example it bends the elbow, turns palms up and assists in brining upper arm forwards.

Origin: Scapula – Coracoid process

Insertion: 1. Radius – Tubercle
2. Fascia of forearm – Bicipital aponeurosis

Common distortions due to tightness is a protracted scapula

BRACHIALIS

Joint Action performed by the Elbow

1. Flexion (primary)

Origin: Humerus (anterior)

Insertion: Ulna – Coronoid process

For example bends elbow such as doing bicep curl

BRACHIORADIALIS

Joint Action performed by the Elbow

1. Flexion

For example bends elbow with thumb pointed up
Origin: Humerus – Lateral supracondylar ridge

Insertion: Radius (lateral distal) – Styloid process

For example hammer curls

Common distortions due to tightness is tennis elbow.

TRICEPS BRACHII (LONG HEAD)

Joint Action performed by Elbow and Shoulder (glenohumeral)

1. Extension – elbow
2. Extension -shoulder
3. Adduction – shoulder

For example straightens elbow

Origin: Scapula – Infraglenoid tubercle

Insertion: Ulna (proximal posterior) – Olecranon process

TRICEPS BRACHII (LATERAL HEAD)

Joint Action performed by Elbow

1. Extension (with supination of forearm)

For example straightening of the elbow with the thumb pointed out

Origin: Humerus (posterior) – Superior to radial groove

Insertion: Ulna (proximal posterior) – Olecranon process

TRICEPS BRACHII (MEDIAL HEAD)

Joint Action performed by Elbow

1. Extension (with pronation of forearm)

For example straightening of the elbow with the elbow pointed in
Origin: Humerus (Posterior) – Inferior to radial groove

Insertion: Ulna (Proximal posterior) – Olecranon process

FOREARM

Wrist Extensors

I. Extensor Digitorum
II. Extensor Carpi Radialis Longus
III. Extensor Carpi Radialis Brevis
IV. Extensor Carpi Ulnaris
V. Extensor Indicis
VI. Extensor Digiti Minimi
VII. Extensor Pollicis Longus
VIII. Extensor Pollicis Brevis

Joint Action performed by the Wrist

1. Extension (I,II,III,IV,V,VI,VII)
2. Abduction (II,III,VII,VIII)
3. Adduction (IV)

Joint Action performed by the Fingers

1. Extension – A. Index(I,V) B. Middle (I) C. Ring (I) D. Little (I,VI)
2. Abduction – A. Index (I,V) B. Middle (I) C. Ring (I) D. Little (I,VI)

Joint Action performed by the Thumb

1. Extension (VII,VIII)

Joint Action performed by the Elbow (very weak)

1. Extension (I,II,III,IV)

Origin: 1. Humerus (lateral distal) – Lateral epicondyle (I,II,III,IV,VI)
2. Ulna (Posterior lateral) – (V,VII)
3. Radius (medial lower middle) – (VIII)

Insertion: 1. Fingers (dorsal) A. Four fingers (I) – second and third phalanges B. Index (V) – Proximal phalanx, Dorsal expansion C. Little (VI) – Proximal phalanx
2. Thumb (dorsal) – A. Base of distal phalanx (VII) B. Base of proximal phalanx (VIII)
3. Metacarpals (dorsal) A.Second (II) B. Third (III) C. Fifth (IV)

Common distortions due to tightness include tennis elbow (lateral epicondylosis) due to overuse. This may be due to t excessive repetitive wrist extension in order to compensate for lack of external rotation in the glenohumeral joint (common in racquet sports.

WRIST FLEXORS

I. Flexor digitorum superficialis
II. Flexor digitorum profundus (four heads)
III. Flexor carpi radialis
IV. Flexor carpi ulnaris
V. Palmaris longus
VI. Flexor pollicis longus

Joint Action performed by the Wrist

1. Flexion (I,II,III,IV, V, VI)
2. Abduction (III)
3. Adduction (IV)

Joint Action performed by the Fingers

1. Flexion (I,II)
2. Adduction (I,II)

Joint Action performed by the Thumb

1. Flexion (VI)

Joint Action performed by the Elbow (very weak)

1. Flexion (I,III,IV,V)

Origin: 1. Humerus (medial distal) – Medial epicondyle (I,III,IV,V)
2. Ulna – A. Medial coronoid (I) B. Proximal ¾ (anterior & medial) (II)
C. Proximal posterior (IV)
3. Radius (middle anterior) (I,VI)

Insertion: 1. Fingers (palmer surface) A. Sides of middle phalanges (I) B. Base of distal phalanges (II)
2. Thumb (palmer surface) – Base of distal phalanx (VI)
3. Metacarpals - A. Second & third (III) B. Fifth (IV) C. Second, third, fourth, fifth. *Palmer aponeurosis (V)*
4. Carpals (medial) (IV) – A. Pisiform B. Hamate

Common distortions due to tightness is a median and ulnar nerve entrapment. It is important to assess these muscles, along with other soft tissues in the forearm and wrist, with carpal tunnel syndrome.

PRONATOR TERES

Joint Action performed by the Forearm

1. Secondary pronator
2. Flexes

For example it turns the palm of the hand downward

Origin: 1. Humerus – Medial epicondyle
2. Ulna – Coronoid process

Insertion: Radius (midway along lateral aspect)

Common distortions due to tightness is a median nerve entrapment mimicking or contributing to carpal tunnel syndrome

PRONATOR QUADRATUS

Joint Action performed by the Forearm

1. Primary pronator

For example it helps to turn the palm down

Origin: Ulna – Anterior aspect of distal quarter

Insertion: Radius - Anterior aspect of distal quarter

Common distortions due to tightness is a lateral epicondylosis caused by overloading of the supinator

SUPINATOR

Joint Action performed by the Forearm

1. Supinates – turning palming up

Origin: 1. Humerus – Laterl epicondyle
2. Ulna – Supinator crest *Radial Collateral Ligament*

Insertion: Radius – Proximal third (lateral aspect)

Common distortions due to tightness include Lateral epicondylosis and radial nerve entrapment

LOWER EXTREMITY

Adductor Brevis

Joint Action performed by the Hip

1. Adduction
2. Horizontal Adduction – bringing thighs together
3. Flexion (initial)

Origin: Pubis

Insertion: Femur (medial) – A. Lesser trochanter B. Linea aspera

ADDUCTOR LONGUS

Joint Action performed by the Hip

1. Adduction
2. Horizontal Adduction
3. Flexion (initial)

Origin: Pubis

Insertion: Femur (medial) – Linea aspera

ADDUCTOR MAGNUS

Joint Action performed by the Hip

1. Adduction
2. Horizontal adduction
3. Extension
4. External rotation (during adduction)

Origin: 1. Pubis
2. Ischium

Insertion: Femur (medial) – A. Linea aspera 2. Medial condyle (adductor tubercle)

GRACILIS

Joint Action performed by the Hip

1. Adduction
2. Horizontal adduction

Joint Action performed by the Knee

1. Flexion

Origin: Pubis – A. Body 2. Inferior ramus

Insertion: Tibia (superior) – Medial surface

Common distortions due to tightness (all adductors) is excessive hip adduction during gait. This will increase stress on the abductor muscles in order to hold the leg straight. It creates medial force on the knee, causing medial buckling.

PSOAS MAJOR

Joint Action performed by the Hip and Spine

1. Flexion
2. Spine (thoracic & lumbar) – lateral flexion

For example the hip and spine combined bring thigh forward and up. It helps bend the trunk forward against gravity. It assists with adduction, external rotation, and flexion of the lumbar spine.

Origin: Vertebrae (lateral surface) A. Thoracic (T12) B. Lumbar (L1-L5) C. Intervertebral discs

Insertion: Femur – Lesser Trochanter

Common distortions caused by tightness include restriction of hip extension, hyperextension of lumbar spine, and flexion of hips and trunk. Exercises such as sit-ups and leg lifts usually emphasize these muscles over the abdominal muscles. Illiopsoas is commonly referred to as one muscle, however, they are two separate muscles working synergistically (Psoas and Iliacus)

ILIACUS

Joint Action performed by the Hip and Spine

1. Flexion
2. Spine (thoracic & lumbar) – lateral flexion

For example the hip and spine combined bring thigh forward and up. It helps bend the trunk forward against gravity. It assists with adduction, external rotation, and flexion of the lumbar spine when femur is stabilized

Origin: Iliac fossa to the tendon of the Psoas Major

Insertion: Femur – Lesser Trochanter

Common distortions caused by tightness include restriction of hip extension, hyperextension of lumbar spine, and flexion of hips and trunk. Exercises such as sit-ups and leg lifts usually emphasize these muscles over the abdominal muscles. Illiopsoas is commonly referred to as one muscle, however, they are two separate muscles working synergistically (Psoas and Iliacus). Treat them as two muscles and you will get better results. They have different origins, but insert together on the femur

PECTINEUS

Joint Action performed by the Hip

1.Adduction
2. Horizontal Adduction
3. Flexion (initial)

Origin: Pubis – upper border

Insertion: Femur – below trochanter

HIP EXTERNAL ROTATORS

I. Piriformis
II. Gemellus Superior
III. Obturator Internus
IV. Gemellus Inferior
V. Obturator Externus
VI. Quadratus Femoris

Joint Action performed by the Hip

1. External Rotation (I,II,III,IV,V,VI)
2. Horizontal abduction (I,V)

Origin: 1. Sacrum – A. Anterior (I) B. Sacrotuberous ligament (I)
2. Ischium – Posterior portions – A. Ischial spine (II) B. Ischial tuberosity C. Posterior portion (IV) D. External border (VI) E. Obturator foramen (V,VI)
3. Ischium and pubis – inside surface and obturator membrane (III)

Insertion: Femur – Greater Trochanter – A. Medial surface (II,III,IV) B. Superior/medial spine (I) C. Posterior surface D. Quadrate tubercle (VI) E. Trochanteric fossa (V)

Common distortions due to tightness include restricted internal rotation of the hip, winging of the foot (toe-out) during gait, and may cause sciatic nerve impingement

Gluteus Maximus – I. Upper Fibers
II. Lower Fibers

Joint Action performed by the Hip

1. Extension (I,II)
2. External rotation (I,II)
3. Horizontal abduction (I,II)
4. Adduction (II)

For example it brings the thigh back and assists in standing from a seated position.

Origin: 1. Ilium (I,II) – Crest (posterior)
2. Sacrum (posterior) (I,II)
3. Thoracolumbar fascia (I,II)

Insertion: 1. Femur – Fluteal line (II)
2. Tibia – Lateral condyle – Iliotibial tract (lateral thigh) (I)

For example exercises such as squats, lunges, bridges

Common distortions due to weakness include inability to squat. Tight hamstrings and erector spinae due to overcompensation. This will lead to instability of the trunk and overloading of the facet joints in the lumbar spine.

Gluteus Medius – I. Anterior Fibers
II. Posterior Fibers

Joint Action performed by the Hip

1. Abduction (I,II)
2. Horizontal Abduction (I,II)
3. Internal rotation (I)
4. External rotation (during abduction) (II)

For example it lifts leg out to the side and turns it in.

Origin: Ilium – External surface just below crest. A. Anterior (I) B. Posterior (II)

Insertion: Femur – Greater trochanter – Posterior and lateral surface (I,II)

Exercises include squats (with tubing around knees emphasizing abduction), lunges, and lateral lunges
Common distortions due to weakness include buckling knees during squats and over-adduction during gait

GLUTEUS MINIMUS

Joint Action performed by the Hip

1. Abduction
2. Horizontal abduction
3. Internal rotation (during abduction)

Origin: Ilium – External surface (below the origin of the gluteus medius)

For example lifts leg out to the side and turns it inward

Insertion: Femur – Greater trochanter – Anterior surface

Exercises include squats (with tubing around knees emphasizing abduction), lunges, and lateral lunges

Common distortions due to weakness are buckling knees during squats and over-adduction during gait

TENSOR FASCIAE LATAE

Joint Action performed by the Hip

1. Abduction
2. Flexion
3. Internal rotation

Joint Action performed by the Knee (via iliotibial band)

1. Assists in extension

For example kicking your leg out to the side

Origin: Ilium – A. Outer lip of crest B. Anterior superior iliac spine

Insertion: Iliotibial band (to lateral condyle of tibia
Common distortions caused by tightness include lateral tracking of femur during hip flexion

SARTORIUS

Joint Action performed by the Hip

1. Flexion
2. Abduction
3. External rotation

Joint Action performed by the Knee

1. Flexion

For example it brings the knee up and turns thigh outward (crossing legs when sitting).

Origin: Ilium – Iliac spine (anterior superior)

Insertion: Tibia – Medial condyle (anterior)

Common distortions due to tightness is a restriction of hip extension and internal rotation. Some sports associated with these movements include ballet, soccer, and skating

HAMSTRINGS

Biceps Femoris (Long Head)

Joint Action performed by the Knee

1. Flexion
2. External Rotation

Joint Action performed by the Hip

1. Extension

Origin: Ishium – Ischial tuberosity

Insertion: 1. Tibia – Lateral condyle
2. Fibula – Head

BICEPS FEMORIS (SHORT HEAD)

Joint Action performed by the Knee

1. Flexion
2. External rotation

Origin: Femur (posterior) – A. Linea aspera B. Lateral condylar ridge

Insertion: 1. Tibia – Lateral condyle
2. Fibula – Head

SEMITENDINOSUS

Joint Action performed by the Knee

1. Flexion
2. Internal rotation

Joint Action performed by the Hip

1. Extension

Origin: Ischium – Ischial tuberosity

Insertion: Tibia – Medial condyle

SEMIMEMBRANOSUS

Joint Action performed by the Knee

1. Flexion
2. Internal rotation

Joint Action performed by the Hip

1. Extension

Origin: Ishium – Ishial tuberosity

Insertion: Tibia – Medial condyle

Common distortions caused by tightness is an inability to fully extend the knee, restricted internal rotation of the hip, a weakness of the gluteus maximus, and pelvic tilted posterior (this can lead to increased stress on the lumbar intervertebral discs)

QUADRICEPS

Rectus Femoris

Joint Action performed by the Knee and Hip

1. Extension
2. Flexion – respectively

For example it allows the knee to straighten

Origin: Ilium – anterior inferior iliac spine

Insertion: Tibia – Tuberosity – *Patellar tendon*

Common restrictions due to tightness is a restricted hip extension which causes increased load on lumbar spine. Exercises associated with these muscles are squats and lunges.

VASTUS LATERALIS (EXTERNUS)

Joint Action performed by the Knee

1. Extension

Origin: Femur – Lateral surface

Insertion: Tibia – Tibia – tuberosity – *Patellar tendon*

Common distortions due to tightness may form adhesions with iliotibial band and lateral tracking of patella during gait.

VASTUS INTERMEDIUS

Joint Action performed by the Knee

1. Extension

Origin: Femur – Anterior surface

Insertion: Tibia – Tuberosity – *Patellar tendon*

VASTUS MEDIALIS (INTERNUS)

Joint Action performed by the Knee

1. Extension

Origin: Femur – Medial surface

Insertion: Tibia – Tuberosity – *Patellar tendon*

Common distortions caused by weakness include lateral tracking of patella

GASTROCNEMIUS – I. MEDIAL HEAD II. LATERAL HEAD

Joint Action performed by the Ankle and Knee

1. Plantar flexion (I,II)
2. Flexion (I,II) – respectively

For example it pushes forefoot down and braces back of ankle. It also raises the heel while pushing off during gait

Origin: Femur – A. Medial condyle (Posterior, I) B. Lateral condyle (Posterior, II)

Insertions: Calcaneus – Achilles tendon (I,II)

Common distortions caused by tightness are elevated heels during a squat due to limited dorsiflexion and increased stress on calcaneus

SOLEUS

Joint Action performed by the Ankle

1. Plantar flexion

Origin: 1. Tibia (upper posterior)
2. Fibula (upper posterior)

Insertion: Calcaneus – Achilles tendon

Common distortions caused by tightness are elevated heels during a squat due to limited dorsiflexion and increased stress on calcaneus

POPLITEUS

Joint Action performed by the Tibia

1. Flexion
2. Internal rotation (when femur is fixed)

Joint Action performed by the Femur

1. External rotation (when tibia is fixed)

Origin: Femur – Lateral epicondyle

Insertion: Tibia – posterior medial aspect

Common distortions caused by weakness is a hyperextended knee

Common distortions caused by tightness is an inability to fully extend knee and an internally rotated tibia

FIBULARIS (PERONEUS) LONGUS

Joint Action performed by the Foot

1. Eversion
2. Pronation

Joint Action performed by the Ankle

1. Weak plantar flexion

For example it points the foot down and out

Origin: 1. Tibia – Lateral condyle
2. Fibula – A. Head B. Proximal two thirds C. Deep fascia

Insertion: First metatarsal – Base (lateral side) – *Medial cuneiform*

Common distortions caused by tightness is over-pronation

FIBULARIS (PERONEUS) BREVIS

Joint Action performed by the Foot

1. Eversion
2. Pronation

Joint Action performed by the Ankle

1. Weak plantar flexion

Origin: Fibula – distal two thirds *Intermuscular septum*

Insertion: Fifth metatarsal – Base (lateral aspect)

Common distortions caused by tightness is over-pronation

FIBULARIS (PERONEUS) TERTIUS

Joint Action performed by the Ankle and Foot

1. Dorsiflexion
2. Eversion – respectively

For example it points the foot up and out

Origin: Fibula – Distal one third *Intermuscual septum, Interosseous membrane

Insertion: Fifth metatarsal – Base (dorsal aspect)
Common distortions caused by weakness is a foot drop

PLANTARIS

Joint Action performed by the Ankle and Knee

1. Plantarflexion
2. Flexion – respectively

For example it points the foot down

Origin: Femur – A. Lateral supracondylar line (distal aspect)
B. Popliteal surface *Oblique popliteal ligament*

Insertion: Calcaneus – Posterior aspect via Achilles tendon

Common distortions due to weakness is a heel which is elevate during a squat due to limited dorsiflexion and increased stress on calcaneus

TIBIALIS POSTERIOR

Joint Action performed by the Ankle

1.Inversion
2. Plantar flexion (assists)

For example it points the foot down and in

Origin: 1. Tibia – Posterior lateral aspect
2. Fibula – Proximal two thirds (medial aspect) *Interosseous membrane

Insertion: 1. Navicular – Tuberosity
2. Calcaneus – Sustentaculum tali (first, second, and third cuneiforms)
3. Cuboid – bases (second, third, and fourth metatarsals)

Common distortions due to weakness and tightness respectively are
over-pronation and supination

FLEXOR HALLUCIS LONGUS

Joint Action performed by the Interphalangeal joint of first toe, Ankle, and Foot

1. Flexion
2. Dorsiflexion
3. Inversion – respectively

For example it points the big toe down

Origin: Fibula – Distal two thirds (posterior aspect) * Inerosseous membrane, Intermuscular septum*

Insertion: First distal phalanx – plantar surface

Common distortions caused by weakness include increased risk of hammer toe and over-pronation

Common distortions caused by tightness is plantar fasciitis and turf toe

FLEXOR HALLUCIS BREVIS

Joint Action performed by the First metatarsophalangeal joint

1. Flexion

For example it points the big toe down

Origin: Cuboid – medial plantar aspect - *Tibialis posterior tendon,
Lateral cuneiform*

Insertion: First proximal phalanx – Medial and lateral aspect

Common distortions caused by weakness is increased risk of hammer toe

FLEXOR DIGITORIUM LONGUS

Joint Action performed by the Second through fifth distal interphalangeal joint

1. Flexion

Joint Action performed by the second through fifth metatarsophalangeal joints

1. Flexion

Joint Action performed by the Ankle and Foot

1. Plantar flexion
2. Inversion (assisted) – respectively

For example it points second through fifth toes down

Origin: Tibia – Posterior aspect - *Fascia covering tibialis posterior*

Insertion: Second through fifth distal phalanges – Bases

Common distortions caused by weakness is over-pronation

FLEXOR DIGITORUM BREVIS

Joint Action performed by the Proximal interphalangeal joints

1. Flexion

Joint Action performed by the Metatarsophalangeal joints

1. Flexion (assisted)

For example it points toe down

Origin: Calcaneal tuberosity – Medial process - *Plantar fascia*

Insertion: Second through fifth middle phalanges

Common distortions caused by weakness is a lack of support for the longitudinal and transverse arches

QUADRATUS PLANTE

Joint Action performed by the Second, third, fourth and fifth digits

1. Assists line of pull of flexor digitorum longus
2. Flexion (assists)

Origin: 1. Medial Head – Calcaneus (Medial aspect)
2. Long plantar ligament (Medial aspect)
3. Lateral Head – Calcaneus (Lateral border – plantar aspect)
4. Long Plantar Ligament – lateral aspect

Insertion: Flexor digitorum longus tendon – tendon, dorsal, and plantar aspects

TIBIALIS ANTERIOR

Joint Action performed by the Ankle and Intertarsal

1. Dorsiflexion
2. Inversion (supination) – respectively

For example it pulls the foot up and heel walking

Origin: Tibia – lateral

Insertion: 1. Tarsal – Cuneiform (medial)
2. Metatarsal – first

Exercise for this muscle is reverse calf raise

Common distortions due to weakness include inability to dorsiflex, a foot drop during gait, and the inability to performed a squat without lifting heels

EXTENSOR DIGITORUM LONGUS

Joint Action performed by the Second through fifth metatarsophalangeal joints

1. Flexion

Joint Action performed by Second through fifth interphalangeal joints

1. Flexion

Joint Action performed by the Ankle and Foot

1. Plantar Flexion
2. Eversion (assists) – respectively

For example points second through fifth toes up

Origin: 1. Tibia – Lateral condyle
2. Fibula – Proximal three fourths (anterior aspect) - *Interosseous membrane, Intermuscular septum*

Insertion: Second through fifth middle and distal phalanges – Attaches via dorsal expansion hood

Common distortions caused by weakness is a collapse of the medial longitudinal arch and a foot drop

EXTENSOR DIGITORUM BREVIS

Joint Action performed by Second through fifth metatarsophalangeal joints

1. Extension

Joint Action performed by the Second through fifth interphalangeal joints

1. Extension (assists)

For example points second through fifth toes up

Origin: 1. Calcaneus
2. Lateral talocalcaneal ligament

Insertion: Second through fifth middle and distal phalanges – Attaches, joining extensor digitorum longus via dorsal expansion hood

Common distortions caused by the weakness is foot drop and collapse of medial longitudinal arch

EXTENSOR HALLUCIS LONGUS

Joint Action performed by the First metatarsophalangeal and First interphalangeal joints

1. Extension – for both joints

Joint Action performed by the Ankle and Foot

1. Dorsiflexion (assists)
2. Inversion (assists) – respectively

Origin: Fibula – distal two thirds (anterior aspect) *Interosseous membrane*

Insertion: First distal phalanx – base

Common distortions due to tightness is a depression of the first metatarsal

EXTENSOR HALLUCIS BREVIS

Joint Action performed by the First metatarsophalangeal joint

1. Extension

For example points big toe up

Origin: 1. Calcaneus – Superior and lateral aspects
2. Lateral talocalcaneal
3. Extensor retinaculum – Inferior

Insertion: First proximal phalanx – Base (dorsal surface)

Common distortions caused by weakness is depression of the first metatarsal

ABDUCTOR HALLUCIS

Joint Action performed by the First metatarsophalangeal joint

1. Abduction
2. Flexion (assists)

Origin: 1. Tuberosity (medial process)
2. Plantar Fascia
3. Flexor retinaculum

For example the points big toe in (away from other toes)

Insertion: First proximal phalanx – Base (medial aspect)

Common distortions due to weakness is Hallux valgus or the big toe pointed out towards other toes

ADDUCTOR HALLUCIS

Joint Action performed by the First metatarsophalangeal joint

1. Adduction
2. Flexion (assists)

For example points big toe out towards other toes

Orign: 1. Oblique Head
2. Second, Third, and fourth metatarsals – Bases
3. Peroneus longus tendon sheath

Insertion: 1. Transverse Head
2. Third, Fourth and fifth plantar metatarsophlangeal ligaments
3. Deep transverse metatarsal ligament

Common distortions caused by tightness is Hallux valgus or the big toe pointed out towards other toes

CHAPTER 2

1. Hyperextension
    A. Moving a body part in an inferior direction
    B. More extension than normal
    C. Toward body
    D. None of the above

2. Supination
    A. Circular movement
    B. Forward motion, occurs at glenohumeral joint
    C. Palm turning upward.
    D. All of the above

3. Internal rotation-
    A. While rotating on its own long axis, the anterior surface moves toward the midline.
    B. Moving or lifting and body part in a superior direction.
    C. Pointing foot away from body
    D. None of the above

4. Elevation is moving a body part in superior direction.
    A. True
    B. False

5. Plantar flexion (ankle) is pointing foot up towards body.
    A. True
    B. False

6. Depression is moving a body part in an inferior direction.
    A. True
    B. False

7. Dorsiflexion(ankle) is pointing foot up towards body.
    A. True
    B. False

8. Plantarflexion is turning feet inward so the soles face each other
    A. True
    B. False

The test will ask questions about muscle attachments and function. We suggest taking the complete Functional course practice test in your online account.