

Planes

There are several different **planes** that we use to describe the body and movements.

There are **three major planes**.

Sagittal plane

- Divides the body into left and right halves
- Median plane refers to the midline
- Paramedian plane refers to subdividing one half

Example: flexion and extension of the hip occurs in the sagittal plane

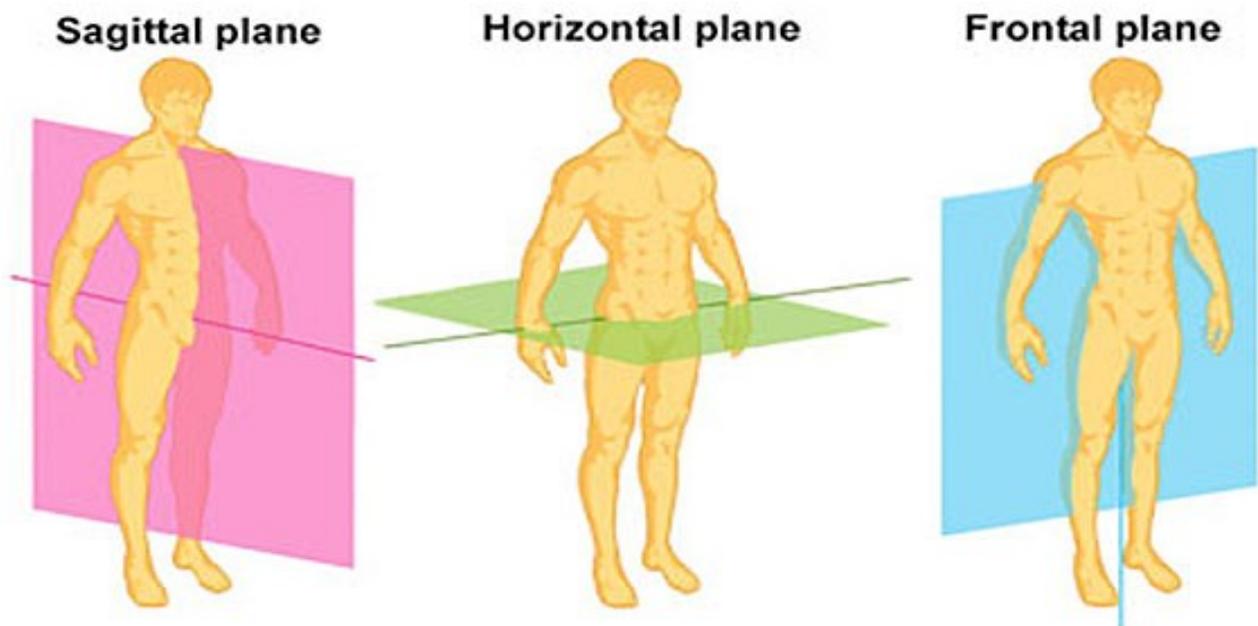
Coronal plane

- Divides the body into anterior and posterior halves

Example: abduction and adduction of the shoulder occurs in the coronal plane

Transverse/axial plane

- Divides the body into superior and inferior halves
- Example: left and right rotation of the atlantoaxial joint occurs in the transverse plane



Axes

There are also several different **axes** we use to describe the movement of a joint. It is useful to think of an axis as a metal pole, and the joint rotating around this pole.

Sagittal axis

- Passes horizontally from anterior to posterior
- Formed by the intersection of the sagittal and transverse planes

Example: abduction and adduction of the shoulder about the sagittal axis

Coronal axis

- Passes horizontally from left to right
- Formed by the intersection of the coronal and transverse planes

Example: flexion and extension of the hip occurs about the coronal axis

Vertical axis

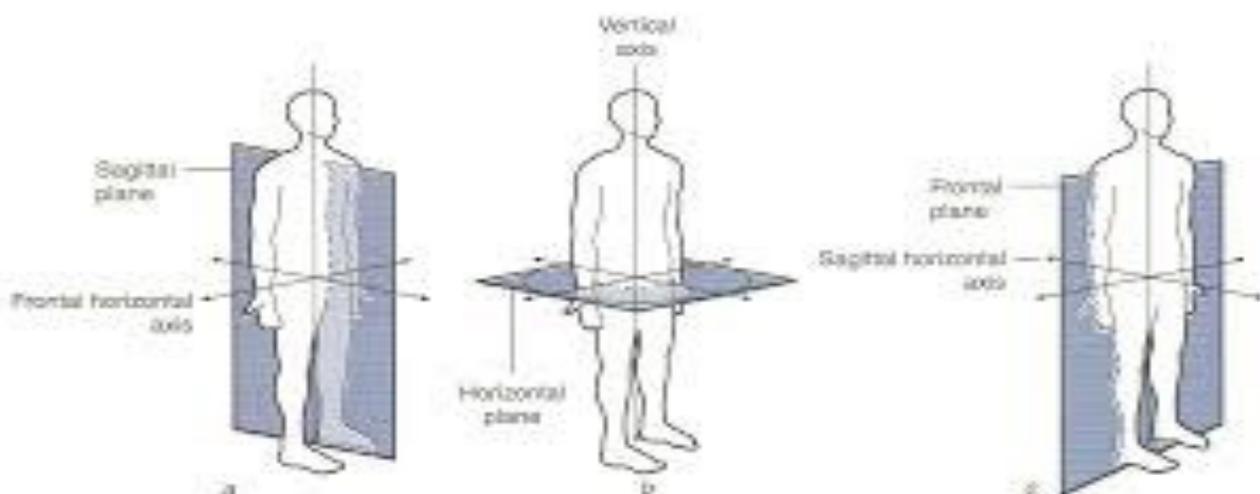
- Passes vertically from superior to inferior
- Formed by the intersection of the sagittal and coronal planes

Example: left and right rotation of the atlantoaxial joint occurs about the vertical axis

Movements in an axis and along a plane

- Bringing together planes and axes, we will describe the movements we used above.
- Flexion and extension of the hip occur in the sagittal plane, and about the coronal axis.
- Abduction and adduction of the shoulder occur in the coronal plane, and about the sagittal axis.
- Left and right rotation of the atlantoaxial joint occurs in the transverse plane, and about the vertical axis.

Now, let's make some more sense of what these movements actually are!



Abduction and adduction

Abduction and **adduction** refer to movements made about a sagittal axis and along the coronal plane. Abduction is moving a body part away from its resting anatomical position in the coronal plane; adduction is returning it to its normal resting position (includes 'hyperadduction').

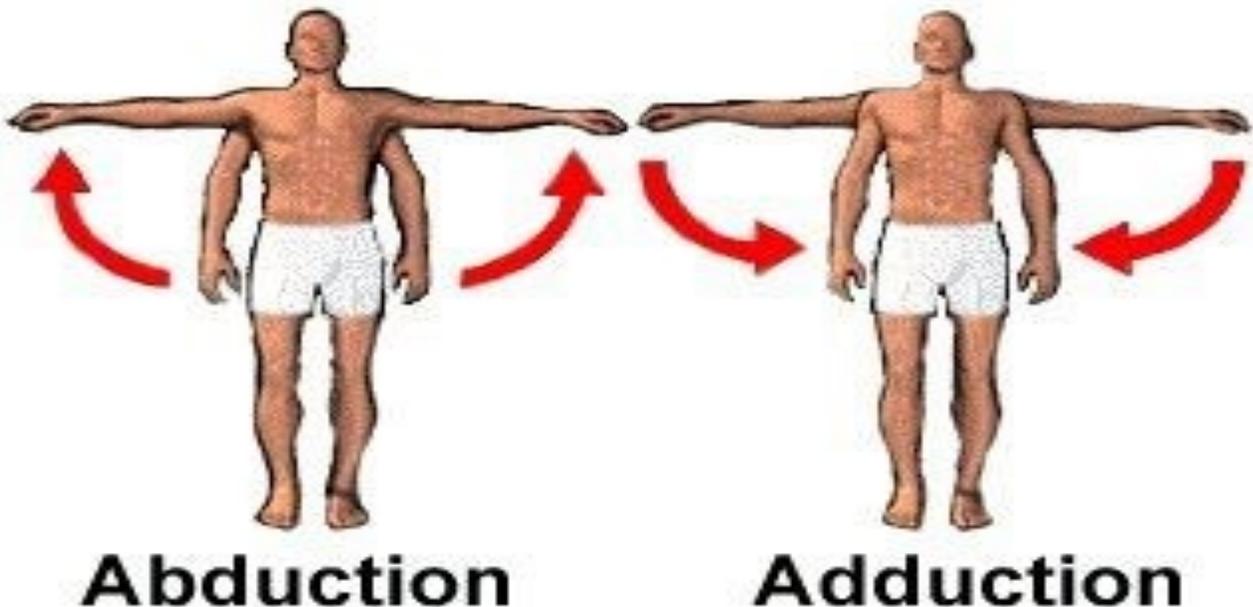
Examples of abduction

- Abducting the shoulder joint to lift the upper limb closer to the ears;

Abducting the hip joint to lift move the lower limbs away from each other

Examples of adduction

- Returning the shoulder joint back to resting anatomical position
- Returning the hip joint back to resting anatomical position (bring the lower limbs together again)



Flexion and extension

When talking about **flexion** and **extension**, we are usually referring to these movements as they occur about the coronal axis, and along the sagittal plane.

Flexion refers to decreasing a joint angle, and extension to increasing the joint angle back to resting anatomical position.

Examples of flexion

- Flexing the elbow to bring the radius and ulna closer to the humerus;
 - Flexing the hip to bring the femur closer to the abdomen;
 - Flexing the knee to bring the tibia and fibula closer to the femur; and
- Flexing the neck (atlanto-occipital joint) to bring the head closer to the chest.

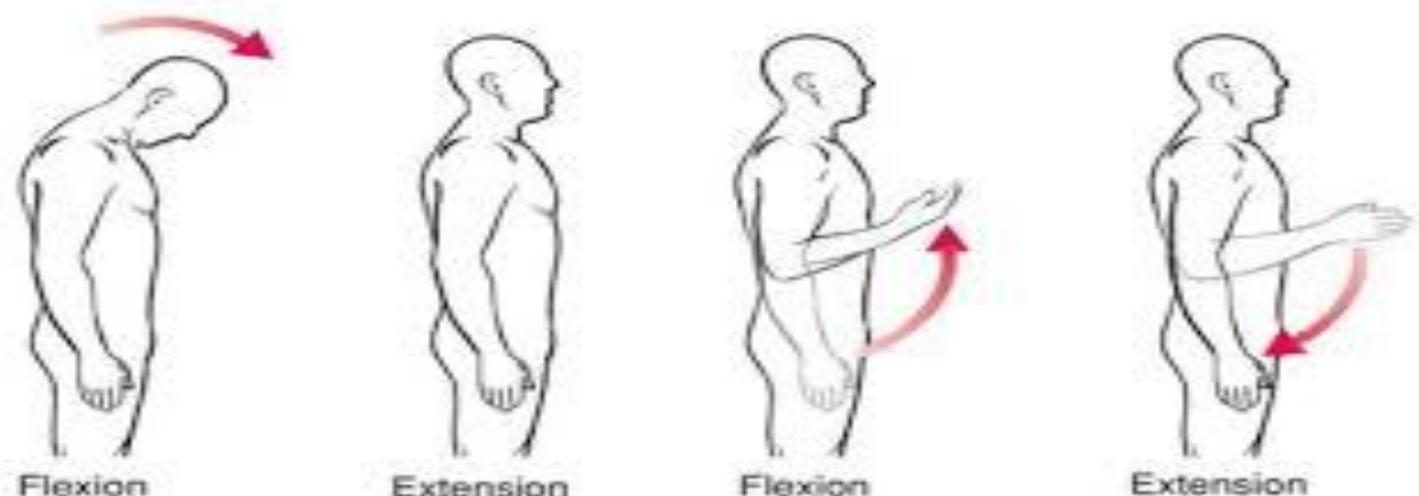
Examples of extension

- Extending the elbow to return the radius and ulna back to resting anatomical position;
- Extending the hip to return the femur back to resting anatomical position;
- Extending the knee to return the tibia and fibular back to resting anatomical position; and

Extending the atlanto-occipital joint to return the head back to resting anatomical position.

Examples of hyperextension

- Hyperextension of the shoulder refers to extending the shoulder past its resting anatomical position so that the arm is now behind the back;
- Hyperextension of the hip refers to extending the hip past its resting anatomical position, contracting the gluteus maximus to bring the femur closer to the vertebral column.



Elevation and depression

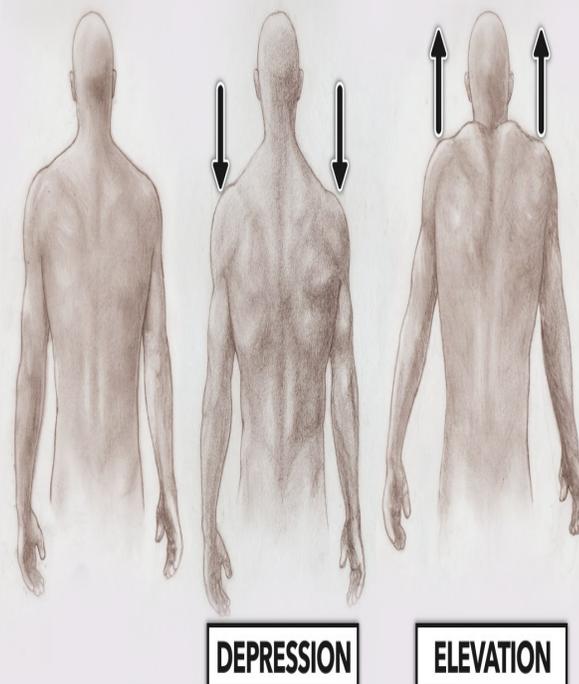
Elevation refers to lifting, and **depression** to lowering. These movements only occur in several regions of the body and are a result of movement along the coronal plane.

Examples of elevation

- Elevating the shoulders to shrug
- Elevating the mandible during mastication to close the mouth

Examples of depression

- Returning the shoulders to resting anatomical position after shrugging
- Depressing the mandible during mastication or phonation to open the mouth.



Internal and external rotation (medial and lateral rotation)

Rotation refers to movements made about the longitudinal axis and in the transverse plane. **Internal rotation** is rotating a joint towards the midline; **external rotation** is rotating a joint away from the midline.

Examples of internal rotation

- With the elbow at 90 degrees of flexion, internally rotating the shoulder brings the forearm and hand toward the body;
Rotating the lower limb at the hip joint to point the feet towards each other

Examples of external rotation

- With the elbows at 90 degrees of flexion, externally rotating the shoulder brings the forearm and hand away from the body – like someone has just scared you!
Rotating the lower limb at the hip joint to point the feet away from each other.



Circumduction

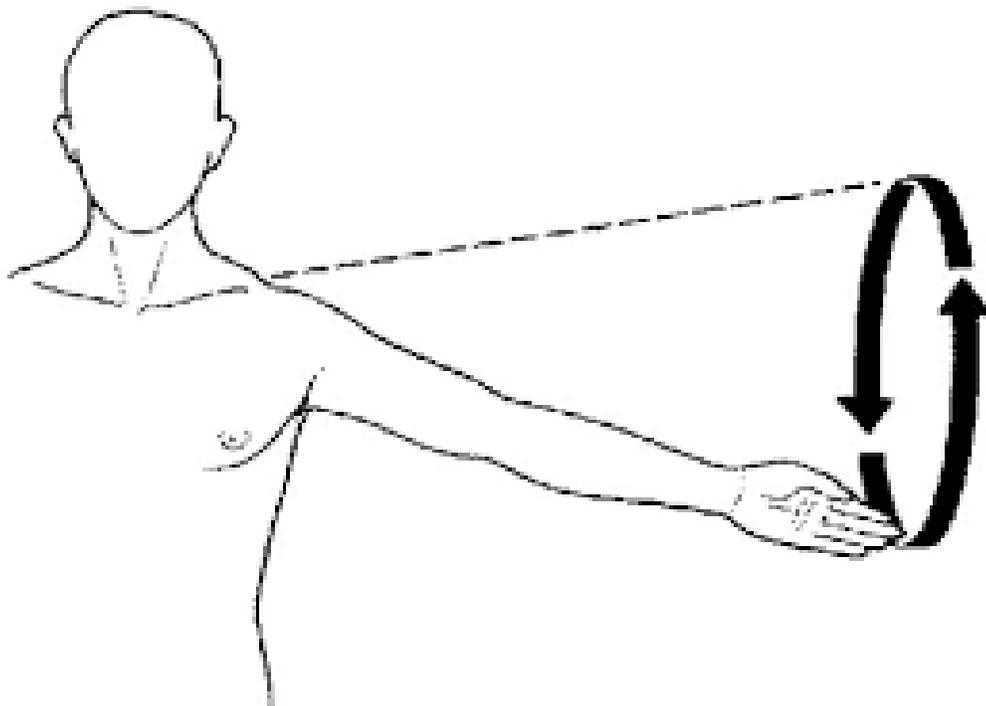
Circumduction is a compound movement that occurs only at ball and socket joints, which can perform multiple movement types.

As image 2 shows, it is a combination of:

- Flexion and extension
- Abduction and adduction

Rotation

It is described as a circular motion utilising each of these movements at different parts of the circular motion. Given that the shoulder and hip are the only joints to use circumduction and they have a relatively 'fixed' joint, the movement is more conical.



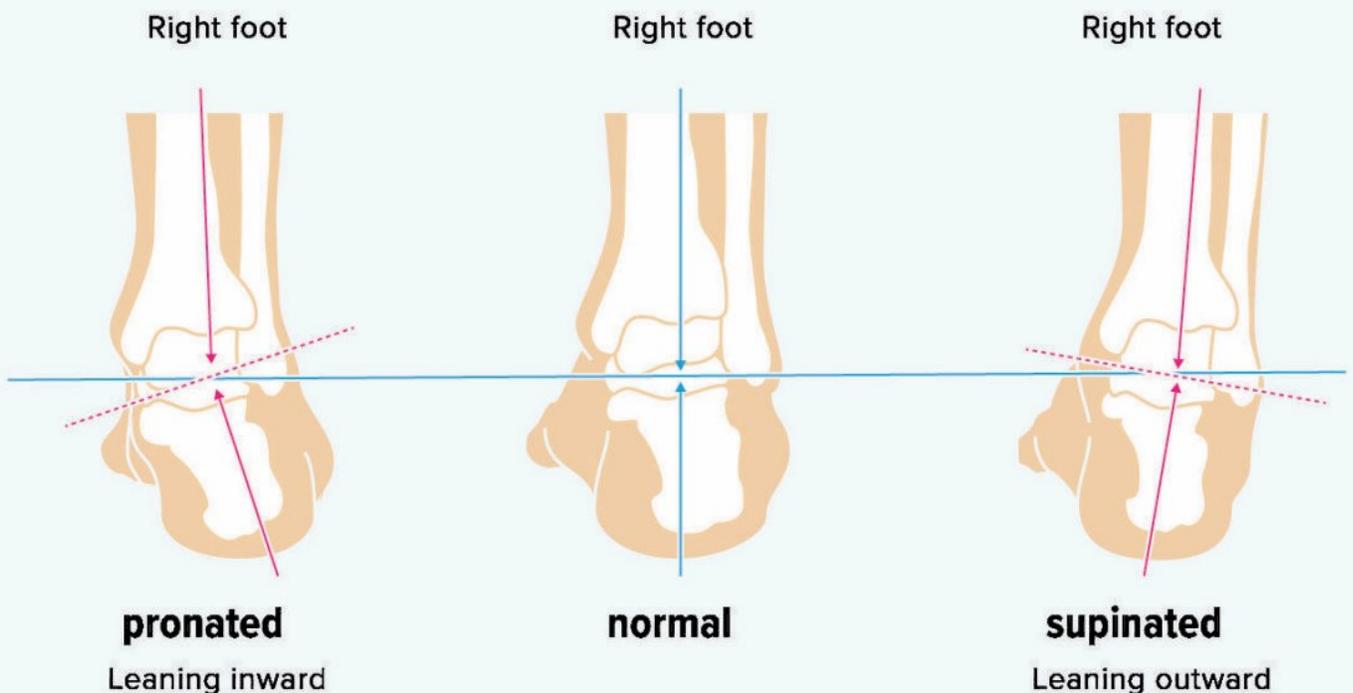
Pronation and supination

Pronation and **supination** occur at pivot joints. The most important example of this is the radiohumeral joint and the union of the radius and ulna through the interosseous membrane.

To remember pronation, think of lying prone (on your belly). Thus, pronation of the radiohumeral joint refers to the palm of the hand facing the ground.

To remember supination, think of holding a bowl of soup. You hold a bowl of soup with your palms facing up – this is the position of supination.

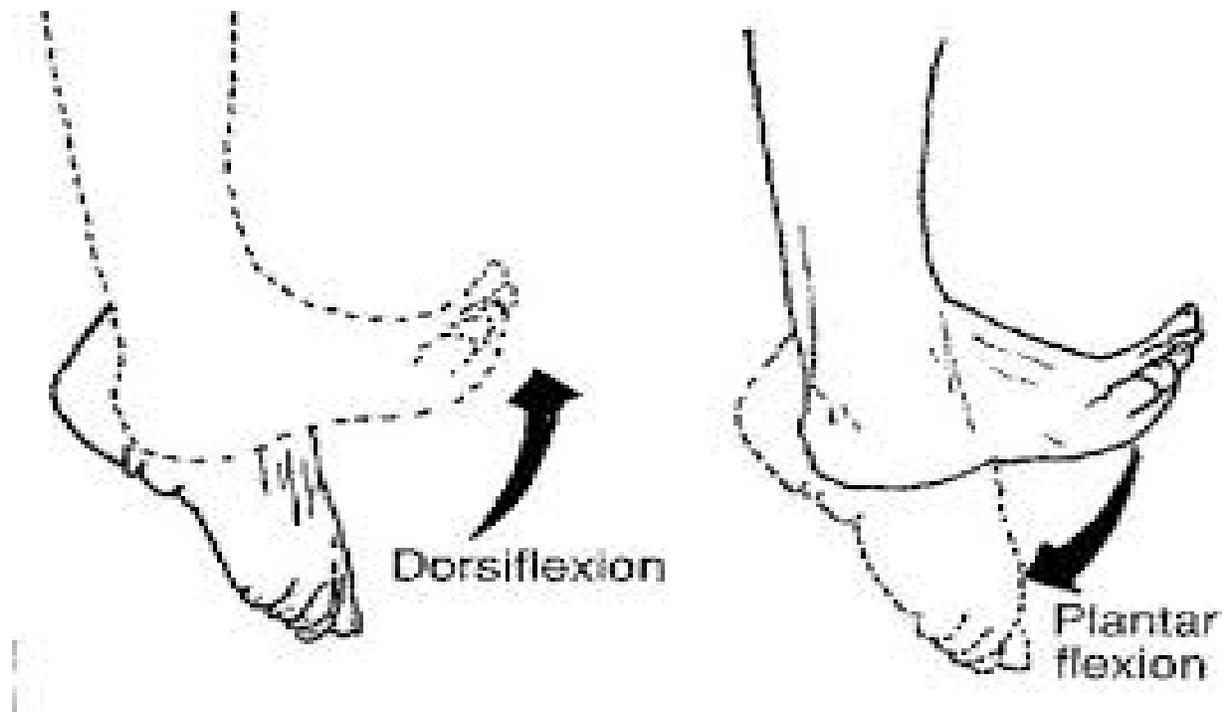
pronation & supination



Dorsiflexion and plantarflexion

The foot is a little special and has four movements specific to it. The first two, **dorsiflexion** and **plantarflexion**, refer to the way the foot moves about the coronal axis and along the sagittal plane. Dorsiflexion brings the dorsum (back) of the foot back toward the tibia, so the toes are beginning to point towards the sky. This is a position of high ankle stability.

Plantarflexion refers to pointing the foot away from the tibia and down into the ground. This is a position of low ankle stability, and most ligamentous ankle sprains occur in a position of plantarflexion.

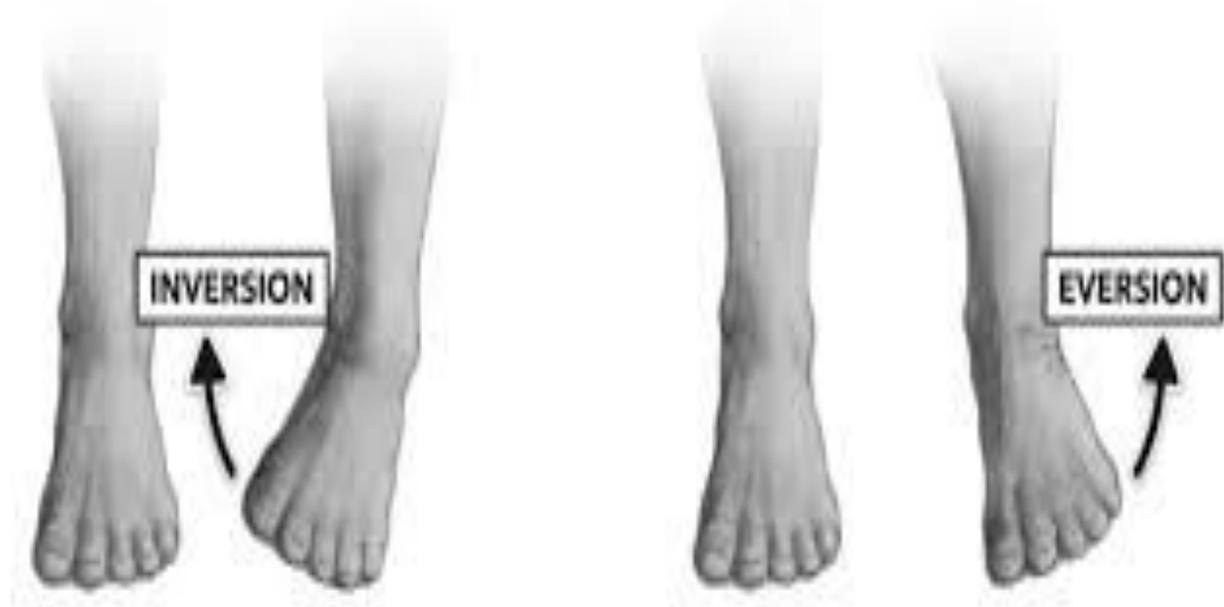


Everson and inversion

The second set of movements specific to the foot are **everson** and **inversion**. These movements occur about the sagittal axis and along the coronal plane.

Everson refers to bringing the soles of the feet out, so they are facing away from the midline of the body.

Inversion refers to bringing the soles of the feet in, so they are facing towards the midline of the body (and each other).

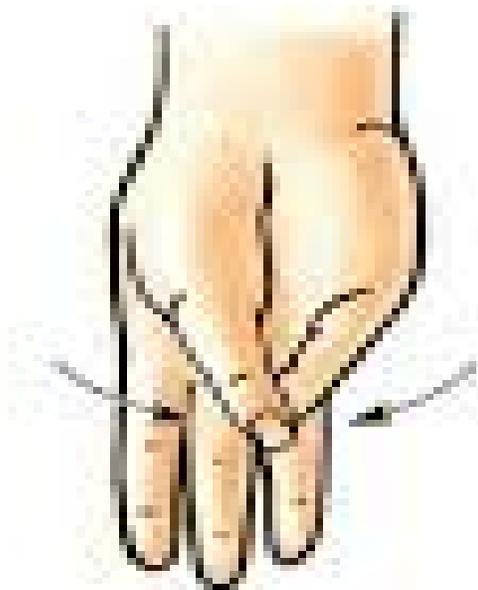


Opposition and re-position

Opposition and **re-position** are special movements unique to the human hand. They are movements that allow us fine dexterity to hold objects. Opposition and re-position occur at the thumb and little finger (digits 1 and 5, respectively). They even have their own separate muscles for this movement!

Opposition of the thumb and little finger refers to the movement of bringing the pads of the thumb and little finger together in the midline of the hand. Technically, the thumb can be opposed to each of the other fingers on the same hand.

Re-position refers to returning the thumb and little (or one of the others!) finger back to resting anatomical position.



Opposition



Re-position

Protraction and retraction (and protrusion and retrusion)

Protraction and **retraction** occur in two major regions of the body – the scapula and the mandible.

Protraction refers to protruding or sticking out. Retraction refers to bringing together.

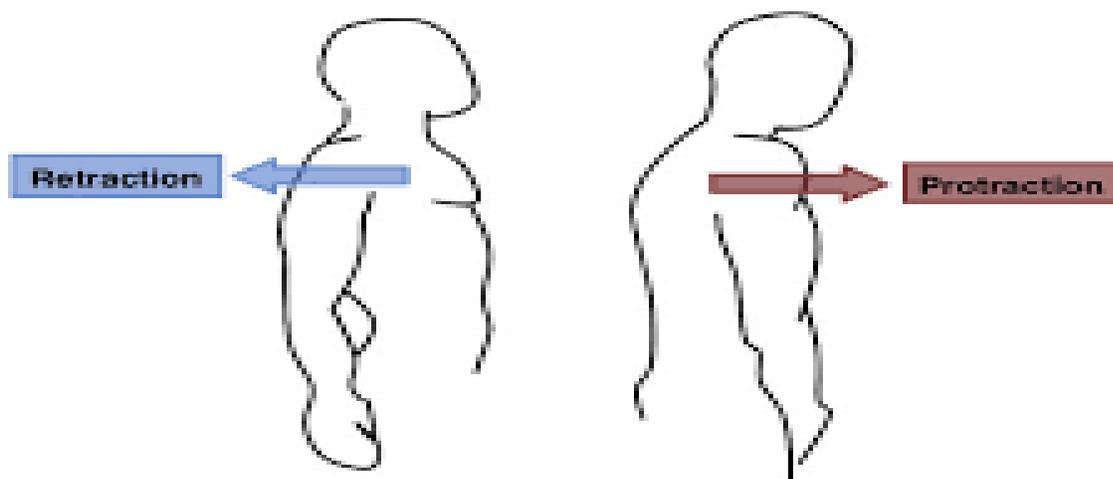
Examples of protraction

- With the shoulder in 90° of abduction, brings the arms forward as if to hug someone. The scapulae begin to slide laterally and then anteriorly along the thorax, this is protraction

Protrusion (similar to protraction) of the jaw allows for anterior movement of the jaw, as if to move it out from the rest of the head

Examples of retraction

- Returning the scapulae from hugging someone with abducted shoulders in front of us to the resting anatomical position of the scapulae
- Retrusion (similar to retraction) of the jaw brings the jaw back to its resting anatomical position.



Sliding

Sliding is a vital movement in the human body but is seldom spoken of. It isn't a movement that is easily visible as it occurs on a relatively small level – nonetheless, it is very important! Sliding occurs in synovial joints with two flat surfaces opposing each other. Examples include the carpal bones of the hand and wrist complex. Sliding allows these bones to move slightly during movements such as flexion or extension of the wrist, or abduction and adduction of the wrist. Without sliding joints in the carpus, we'd find it difficult to move our wrists as well as we do!