

Whether the limb is acting as an open or closed chain is an important concept in understanding the types of exercises or activities best practiced for rehabilitation and exercise. Closed chain activities produce greater torsional stress to the joints and soft tissues, than open chain activities. Therefore, the muscles and joints of the area must withstand the additional demands that are imposed by “closed chain” activities.

## **Open Chain**

When the chain is open, a twisting force at one end causes rotation of the other. As it rotates it “untwists” the chain and so no torsional stress occurs. Relate this to the upper limb when the hand is free to move. Rotation of the shoulder will produce a turning of the hand, as lifting a dumbbell. Here the upper limb is acting as an open chain.

## **Closed Chain**

If the end of the chain is fixed, as, for example, in a push up, the chain will not be able to “untwist”. Any rotation at the shoulder produces torsional stress across the joints between the shoulder and the hand. The greater the rotation then the greater the torsional stress, Here the upper limb is acting as a closed chain.

## **Combination**

The lower limb frequently acts as a closed chain when the foot is fixed to the ground by the body weight. However, if the foot is free, as it is during the “swing” phase of walking, it becomes an open chain. It is important to realize that either the distal (furthest from the trunk) or proximal (closest to the trunk) end of a limb may free to move and so “open” the chain. Take the foot fixed to the ground – if the rotary force is strong enough it will move the proximal segment (the trunk) and this trunk rotation will untwist the chain.

There are also occasions where resistance to movement tends to “close” the chain. Take for example a single arm dumbbell press is an “open chain” movement of the upper limb yet the same weight in a barbell (two hand) press is a “closed chain” movement because the resistance to rotation by each arm. The same in a two legged squat is a “closed chain” for the lower limbs (resistance between legs) while a one legged squat as the trunk to rotate above the leg thus “opening” the chain.