

# Jumping

The highest jumpers possess two attributes. They possess the greatest vertical velocity and greatest takeoff velocity.

**Greatest vertical velocity** means, that when they jump vertically, their structural mass aligns with the axis of gravity. Any structural mass that does not align with the axis of gravity will cause the “jump” to move horizontally, and defeat the ability to jump.

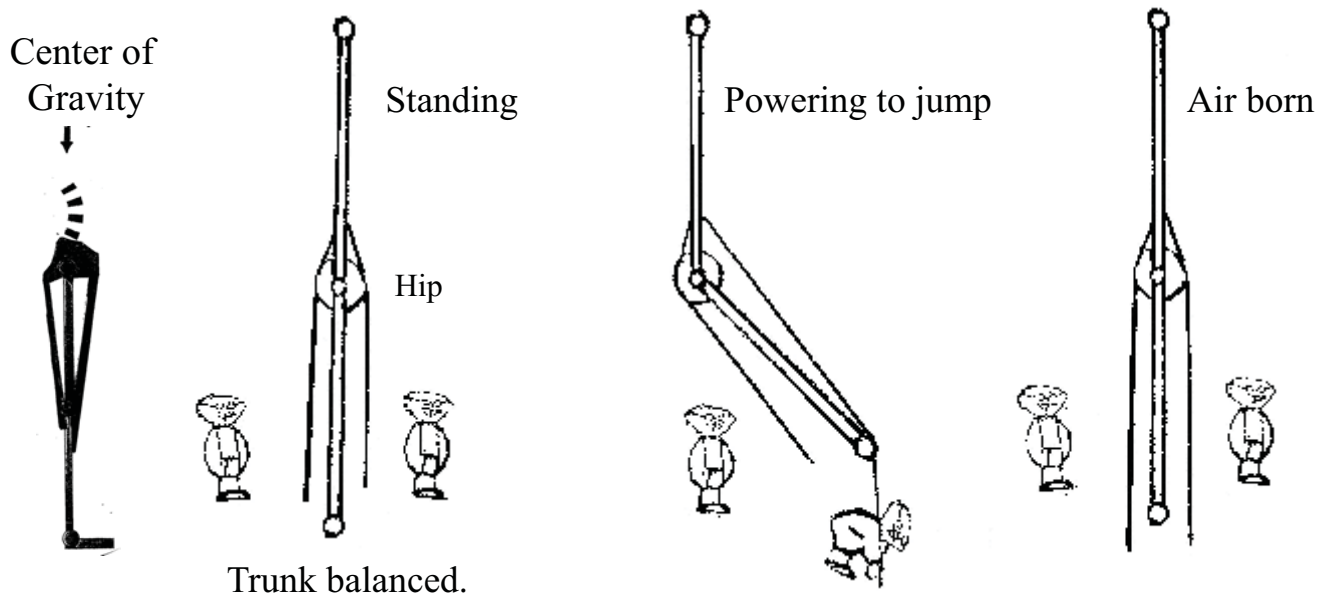
**Greatest takeoff velocity** is a function of fast twitch muscle fiber recruitment. The more muscle fibers that can fire quickly, and together, the more power that can be generated to drive the body into the air.

We will examine good neutral spinal posture and poor neutral spinal posture and how they impact the two attributes necessary to be a good jumper.

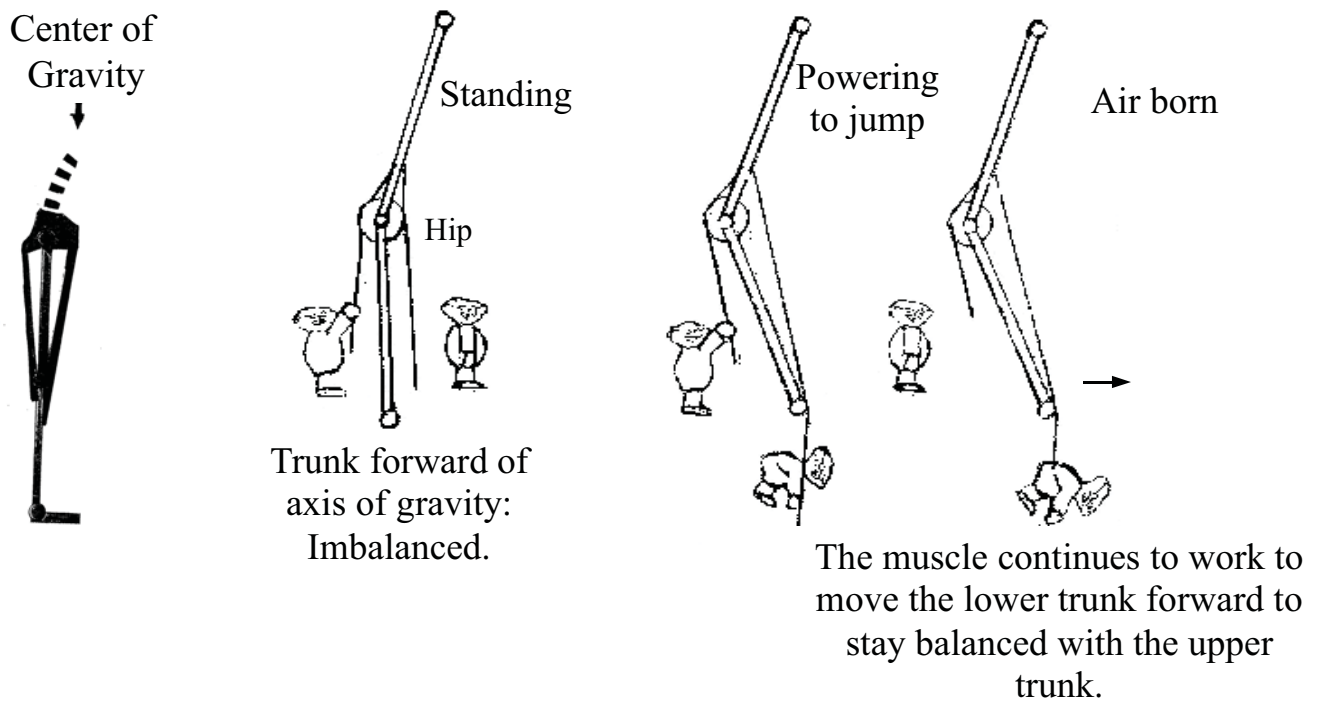
The good jumper has a neutral spinal posture that aligns with gravity. Their upper trunk is balanced against gravity relative to the lower trunk

When they jump they leave the ground aligned with gravity. They have the greatest vertical velocity. The diagram on the next page demonstrates this with respect to the lever action used.

The good jumper looks like this as lever arm diagrams:

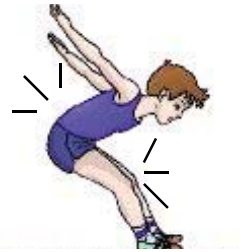


In comparison, the poor jumper looks like this:



The poor jumper has poor neutral spinal posture. Their spine is imbalanced against gravity and they have to expend antagonist muscle effort to maintain upright posture while using agonist muscles are used create the power to jump.

When they jump, the quadriceps concentrically work to develop force to drive the body into the air. The problem is the hamstrings are working antagonistically against the agonistic quadriceps. This will cause the movement to be weak, uncoordinated and stiff. The next problem is, when in the air, the trunk axis is not aligned with gravity. The displacement of the upper trunk mass (head and torso forward and downward) causes the feet and lower body to move up, and forward, involuntarily. This person does not jump upward, they jump forward



Landing causes strain to the joints.

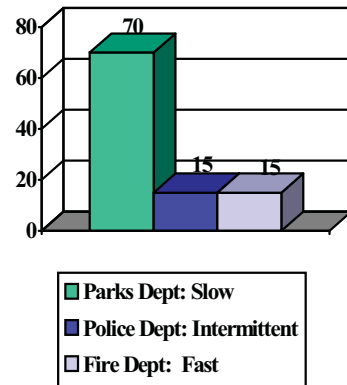
This is a musculoskeletal problem that can not go away with any kind of training, other than spinal fitness training for core stability, to restore proper neutral spinal posture. Poor jumping due to poor vertical direction is a structural problem. When in the air, the nervous system controls joint activity to maintain balance against gravity (Cooper '82).

This is a non-voluntary control mechanism. If you do not restore proper neutral spinal posture, the individual will never be an effective jumper.

Greatest take off velocity (speed) is a function of fast twitch muscle fiber recruitment. The more muscle fibers that fire quickly, and together, the more force that can be generated. We do not jump slow we jump fast. The problem is, how do we train for fast twitch muscle fibers?

What do we know about muscle fibers? We know that all muscle fiber types found in the body are there due to a need. We know that as humans age, we get less and less fast twitch fibers. We know that we see transformation of slow twitch fibers into fast twitch after periods of rest such as from knee surgeries (Lieber '92).

Imagine that the human body is a government entity. We have a finite amount of muscle fibers that are our workers. They are employed in our body as they are needed, and as they are needed, they have adapted special ability (fiber type). The parks department people are the slow twitch. They show up each day, and work slow and steady for hours. The police department makes up the intermittent fibers.



They work steady sometimes, but never too physically demanding, because they have to be ready to work fast in critical situations. The fire department makes up the fast twitch fibers. They do not have to work when not firefighting. They can even sit in easy chairs on-the-job. They have to be rested and ready, so when the fire signal goes off, they are ready to move fast as a group. To get more fast twitch fibers you have to create an environment that the fire department has. The more muscle fibers in your body that must work constantly, the more you transform them to slow twitch fibers and lose the fast twitch that you want.



Has constant work.  
 Moves slow.  
 More slow twitch.



Has work that fluctuates.  
 Some fast twitch, some intermittent twitch.

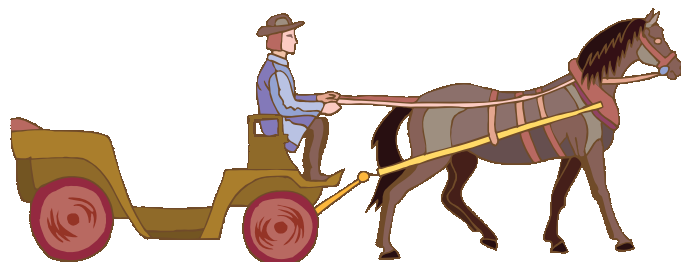


Little constant work.  
 He can rest so that when he has to move fast, his fast twitch fibers are ready.

To train for fast twitch muscle fibers you have to, intelligently, control the external and internal environment of the individual. Controlling the external environment means that you would train according to need. Strengthening and conditioning for sports specific activities has become an exacting science. As a general rule, if you need individuals involved in endurance activities, they would train in a manner that caused the adaptation of slow twitch fibers. You would train and try to control the environment of individuals requiring speed in more explosive resistive movements and with more rest to avoid more slow and steady work that would result in slow twitch fiber adaptation.



More explosive training  
and more rest  
=  
More fast twitch



More endurance and  
slow work  
=  
More slow twitch

Formula for controlling external environment for fast twitch muscle fiber transformation:

Lower the amount of physical exertion the athlete is involved in outside of necessary practice of skills and sports specific physical training.



After practice of skills and sports specific training...rest.

Formula for controlling internal work environment for fast twitch muscle fiber transformation:

Physical training and treatment that enhances, restores and preserves the proper spinal posture.

The center of mass of a balanced spine is in equilibrium over the lower trunk.



The spine is in a minimum energy state. Expenditure of muscle energy for movement (running, standing, contact sports) considering force of resistance and effort through force for stabilization is lowest.

The body's internal structure is environmentally conducive for fast twitch fiber adaptation.

The center of mass of an imbalanced spine is forward of the lower trunk.

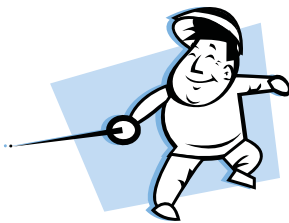


Loss of curve

The spine is in a high energy state. Expenditure of muscle energy for movement considering force of resistance and effort through force of stabilization is highest.

Loss of curve

The body's internal environment is conducive to slow twitch fiber adaptation relative to maintenance of upright posture only.



So...before practice and sports specific training make sure you have the proper neutral spinal posture which gives you core stability.

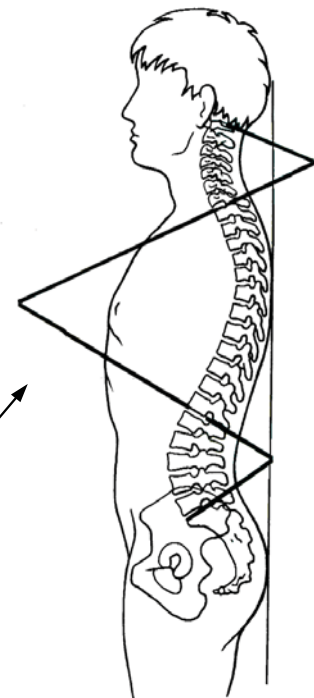
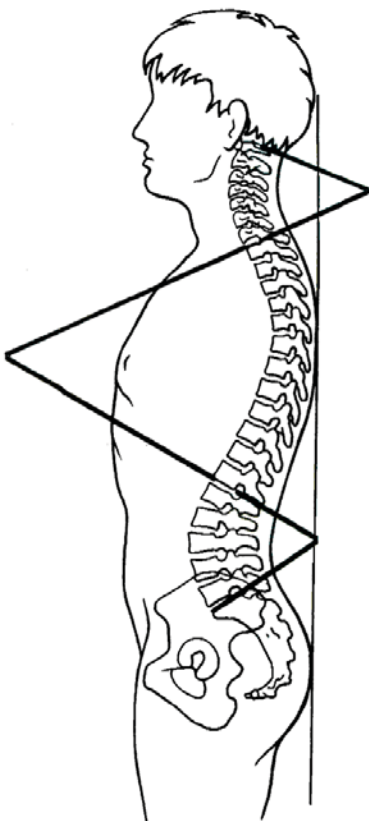


Diagram from: The Physiology of the Joints Vol. 3, Kapandji, I.A., 1974.

To be a fit and healthy individual you *must* have the proper structural neutral spinal posture that provides stability as has been defined and demonstrated in this manual.

In order to: succeed in athletics, have a productive and healthy daily life, and as you age, maintain physical health; obtaining and keeping proper spinal structure is of absolute importance.



Congratulations!!

You have just completed the introduction portion to the manual. With the basic knowledge you have now developed we will proceed onto the mathematical portion.

Diagram from: The Physiology of the Joints Vol. 3, Kapandji, I.A., 1974.