Preview of Course 1 Kinesiological Analysis of Human Spinal Development & Function in Earth's Gravity

John S. Scherger, D.C.
Athletic Spinal Fitness Institute
19321 NE 10th AVE
Ridgefield, WA 98642
(360) 887-8600
www.spinalfitness.com

We Introduce Related Terms in Human Spinal Posture

1. **Proper Neutral Spinal Posture:** The correct adult S-shape posture that functions optimally for human movement in Earth's gravity.
2. **Core Stability:** The one spinal structure from which the body most optimally and safely functions.
3. **Spinal Fitness:** Specific training to obtain the one spinal structure (neutral spine) that gives the body optimum core stability.
4. **Orthopedic:** Restoration and preservation of the proper spinal (skeletal) structure and function.

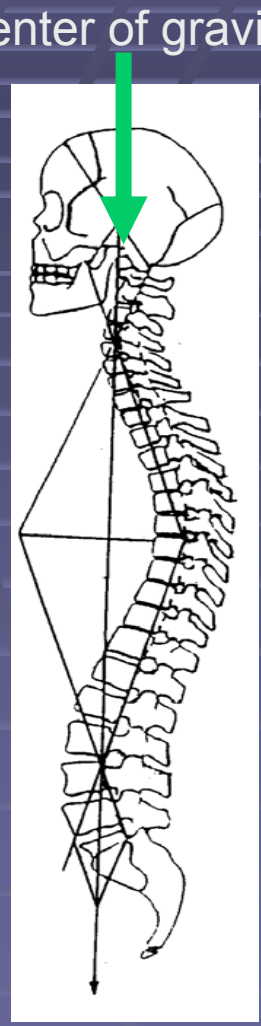
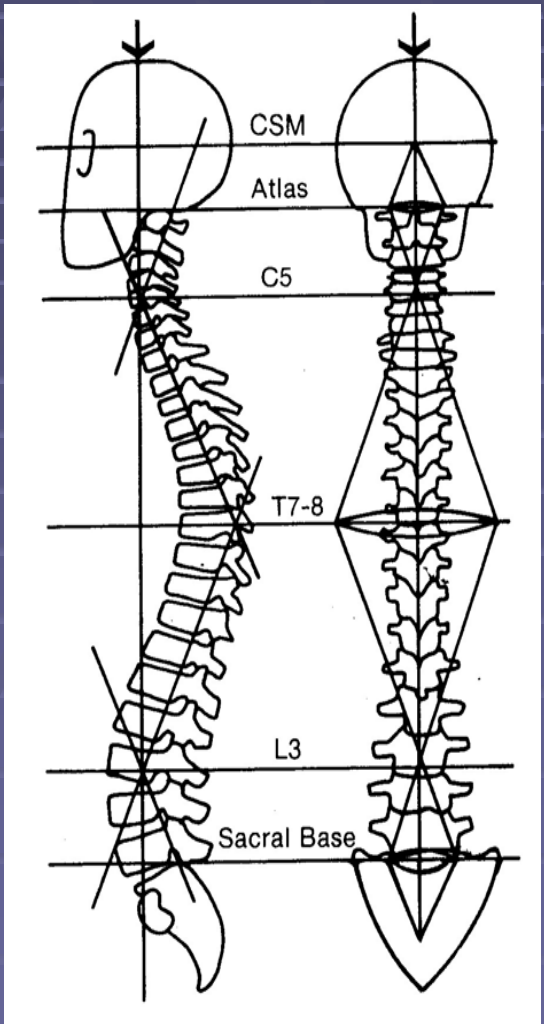
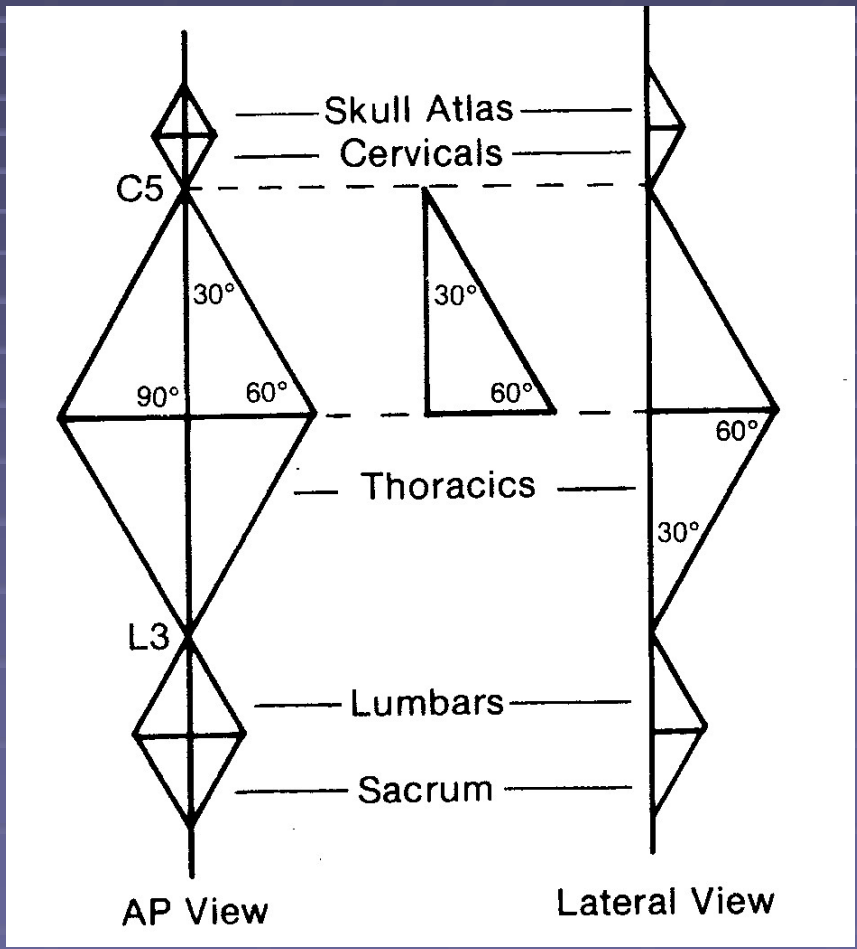


Diagram from Introduction to Spinal Biomechanics, Pettibon, B.R., 1989.

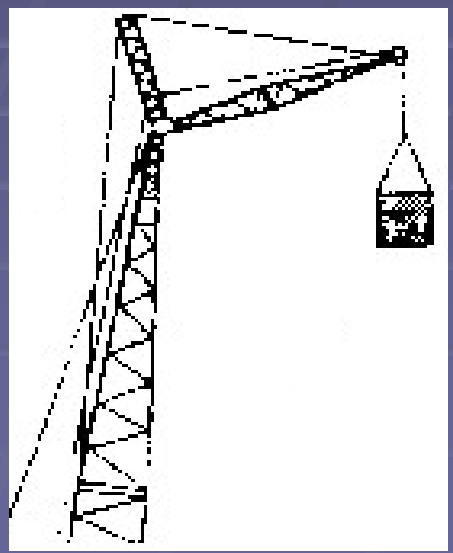
We Define A Specific Spinal Model





Diagrams from Introduction to Spinal Biomechanics, Pettibon, B.R., 1989.

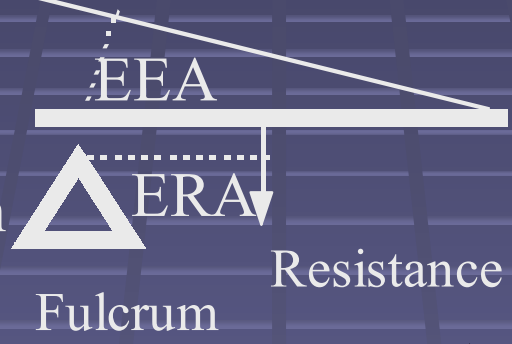
There’s an introduction of human spinal adaptation from the C-shape to the S-shape as it relates to leverage.



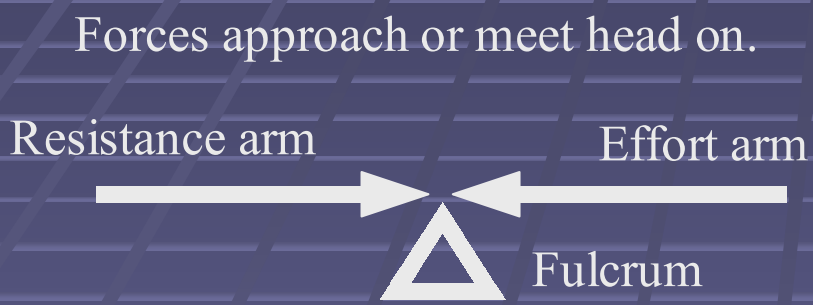
2nd Class

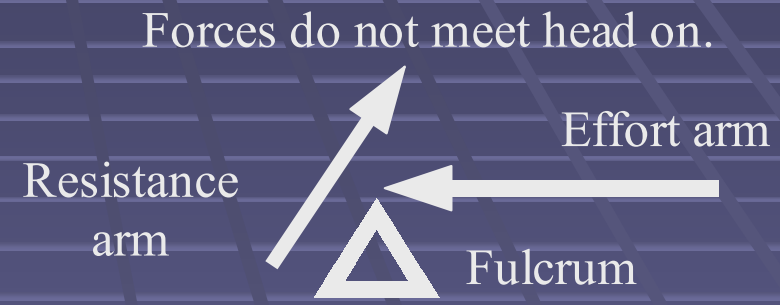
Effort

Effective effort arm (EEA) shorter than effective resistance arm (ERA).



We introduce errors in current lever system identification used in biomechanics, physics and physiology.



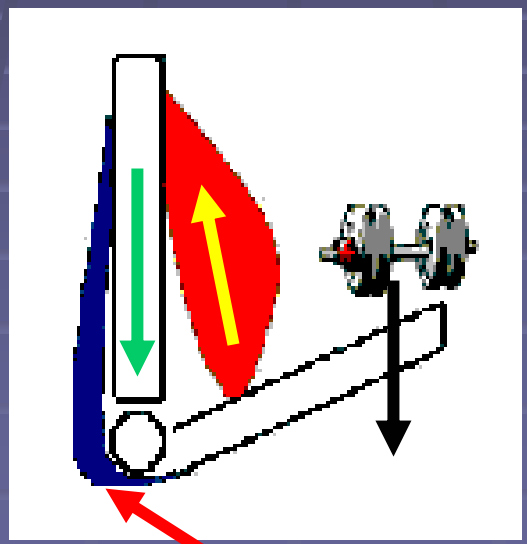


We discuss when the body produces leverage, compression and shear are created at the joints involved.

Structural and functional components of human lever systems are introduced like:
The force of effort, the force of resistance, the resultant force and the stabilizing force.

Direction of pull of effort (yellow)

Stabilizing force (green)



Direction of pull of resistance (black)

Resultant force (red)

See how current training and treatment protocols are not aware of how exercises impact joints.

Hey coach, I heard a leg curl done a certain way can create shear forces on my knee joint.

Well, the leg curl will build up your muscle so you can rehab and run.

Hmm..what's a shear force?

See how the future of training and treatment will understand how exercises impact joints.

Your knee has damage to the anterior cruciate ligament. We will concentrate on exercises that avoid shear into the joint.

OR

Your knee has damaged cartilage, we are going to concentrate on exercises that avoid compressive forces on the joint.

See the past world of fitness.

This is the exercise that will really get you in shape!

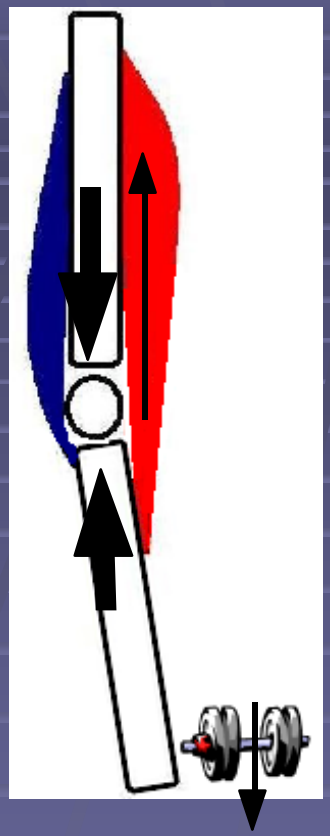
This is the equipment that will get you in shape!

The half story, what you are told.

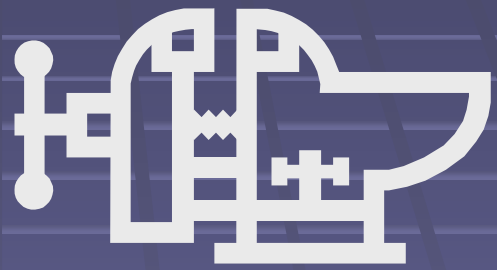
See what the future of fitness looks like and the “truth in exercise” revealed.

What resultant force is created and how does the body develop safe and effective stabilization when using that equipment to perform that exercise.

The whole story,
what you really want to know.

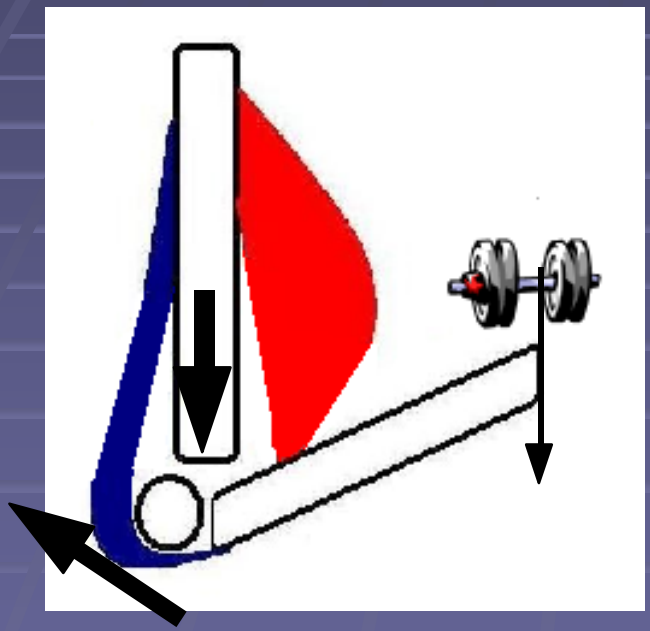


Compression force

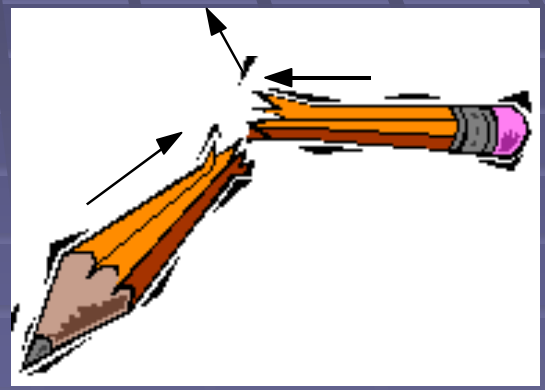


See how at a joint, compression works like a vice for stability.

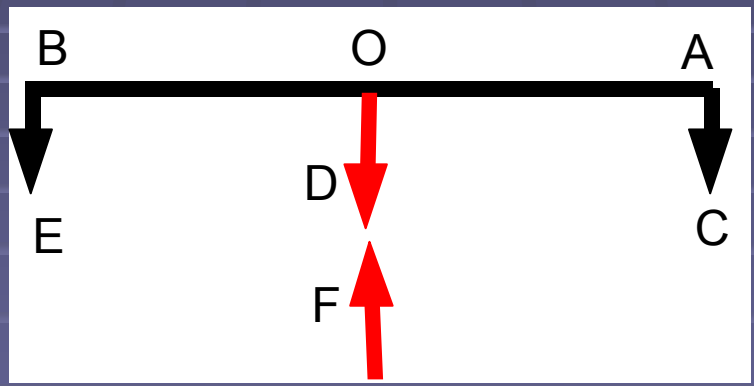
See how at a joint, shear force works to dislocate a joint.



Shear force

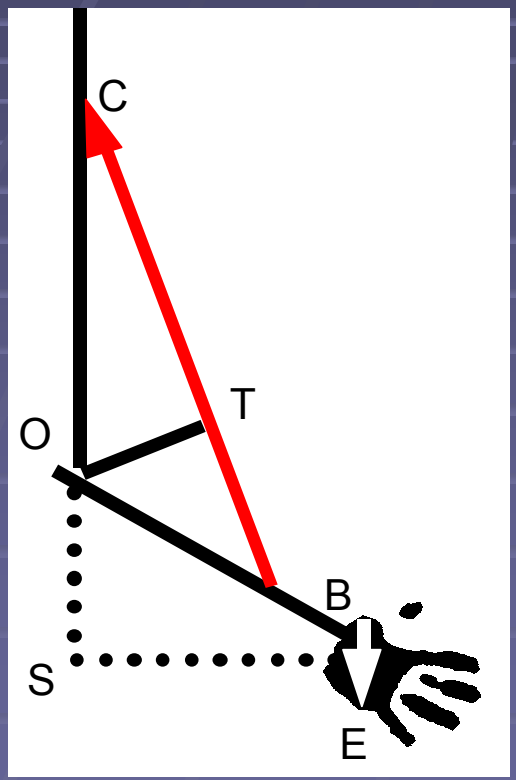


Using vector drawings, we introduce the leverage principles of Equilibrium of Torque and Equilibrium of Translation.



Equilibrium of Translation requires that a force, force F, be in place to push back with the same amount of force of D but in the opposite direction.

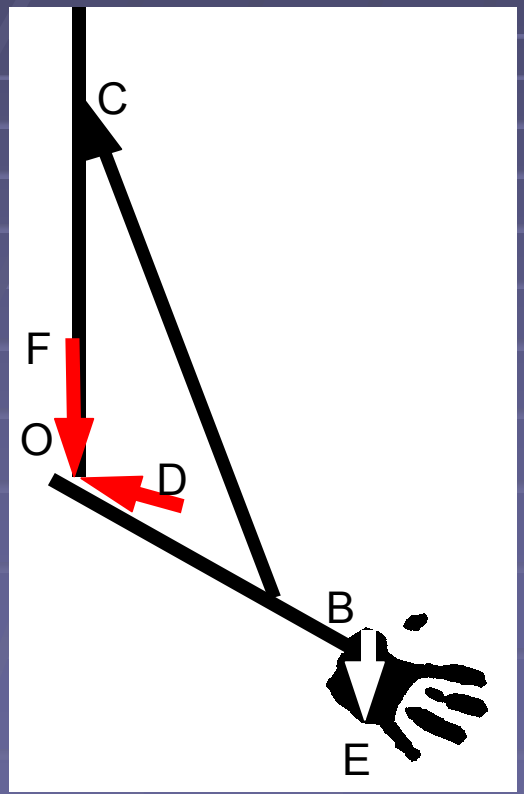
Using drawings, we introduce how the Equilibrium of Torque principle applies to human movement.



Equilibrium of Torque
Determines how much muscle effort is required.

The amount of muscle pull is significant.

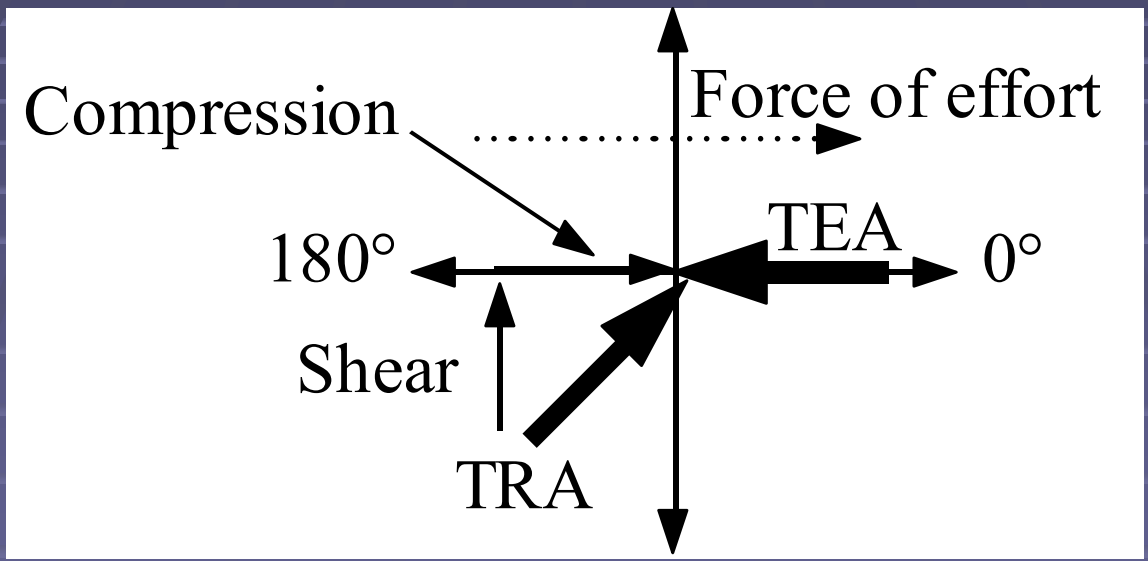
Using drawings, we introduce how the Equilibrium of Translation principle applies to human movement.



Equilibrium of Translation
Determines how the joint and tissue provide stability to stop translation.

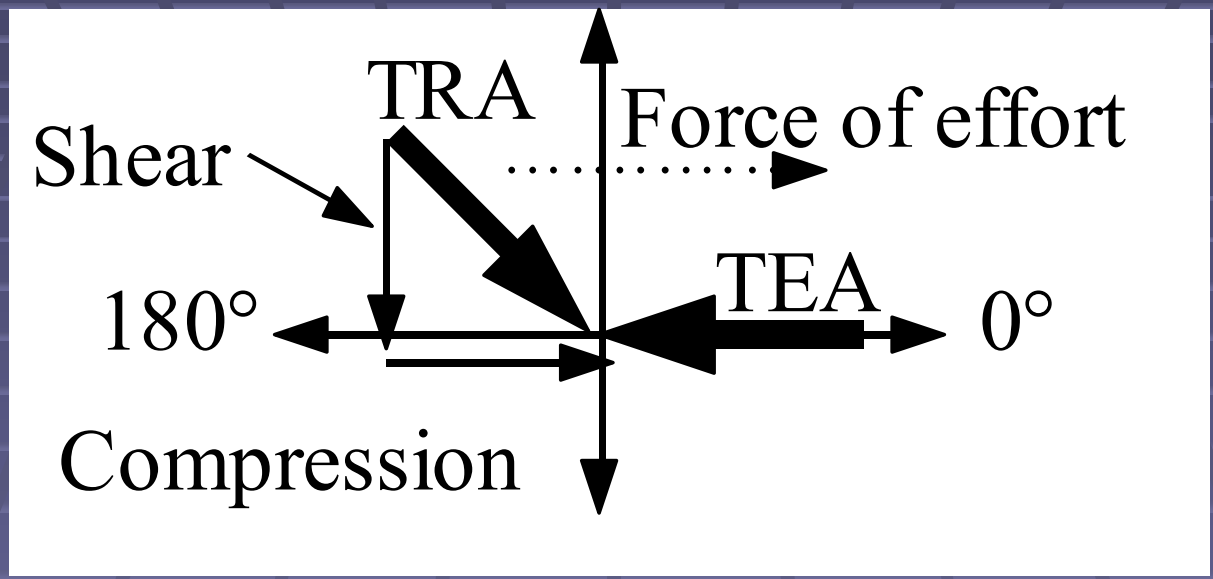
How the resultant force D interacts with the stabilizing force F at the joint is important to understand the Equilibrium of Translation.

We then describe the functional classification of 1st class levers.



- The TEA and TRA are in 180° alignment or greater.
- Any shear present is directed toward the initial force of effort.

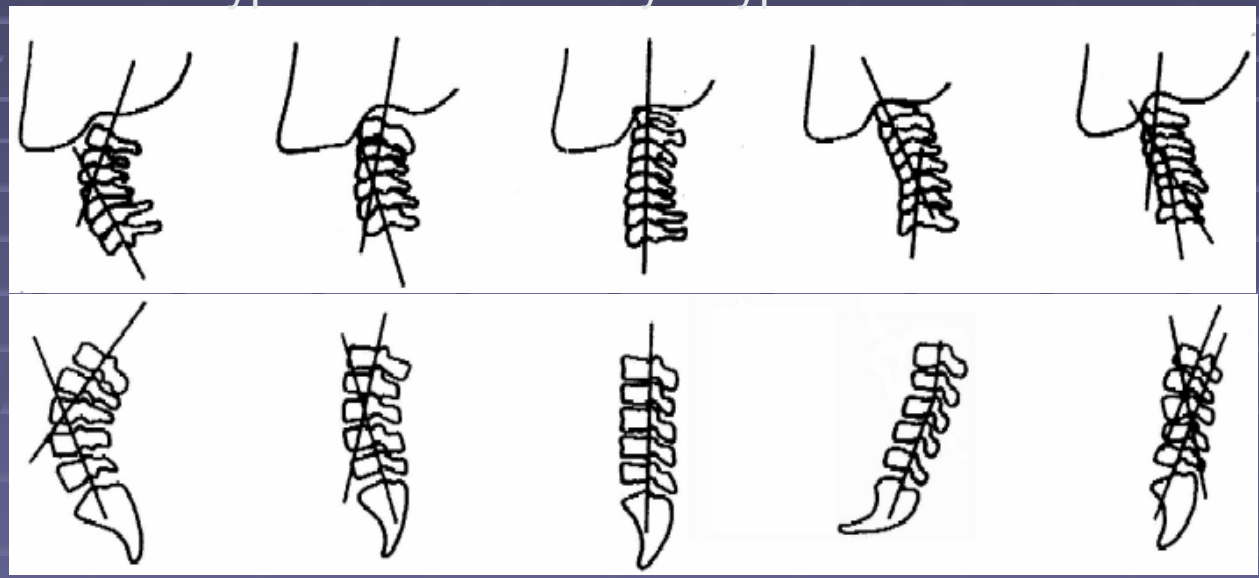
We also introduce the functional classification of 3rd class levers.

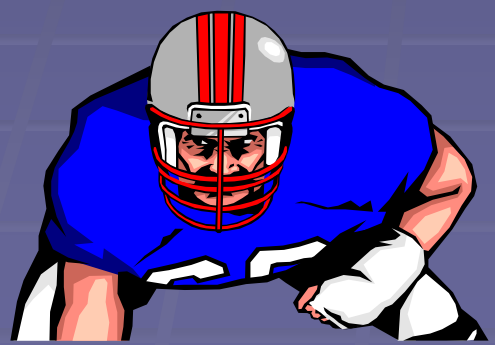


- The TEA and TRA are in less than 180° alignment.
- Any shear present is directed away from the initial force of effort.

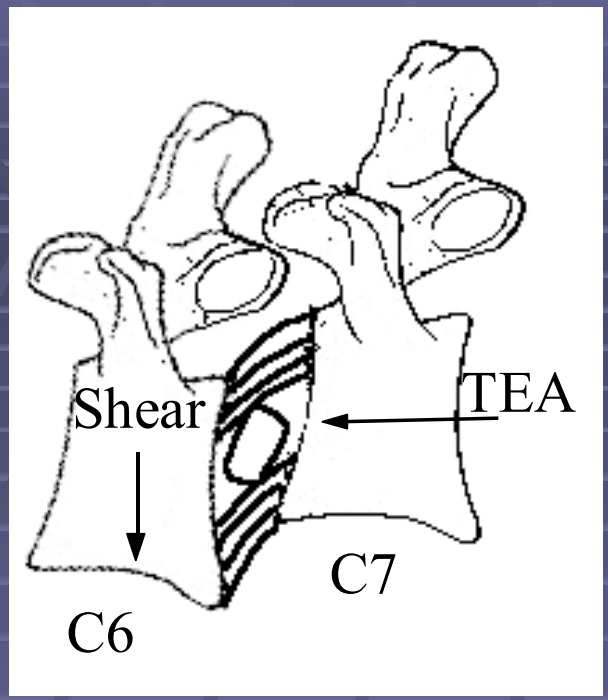
We introduce how the different spinal postures produce different mechanical advantages for the same physical event.

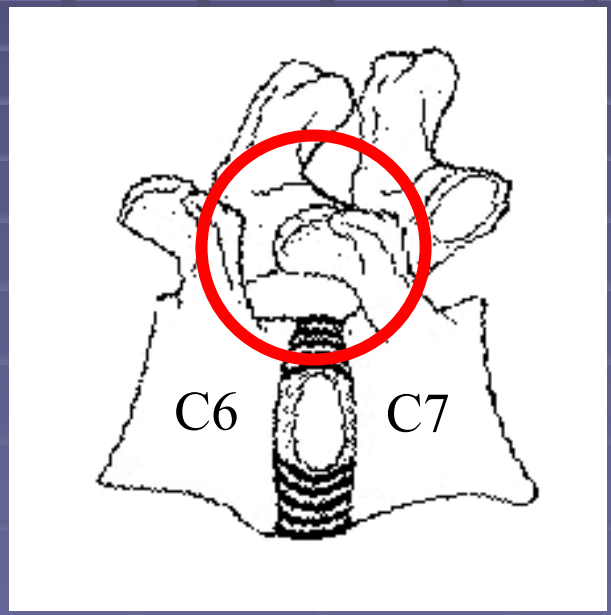
Normal Hypolordotic Military Kyphotic Reversed Curve



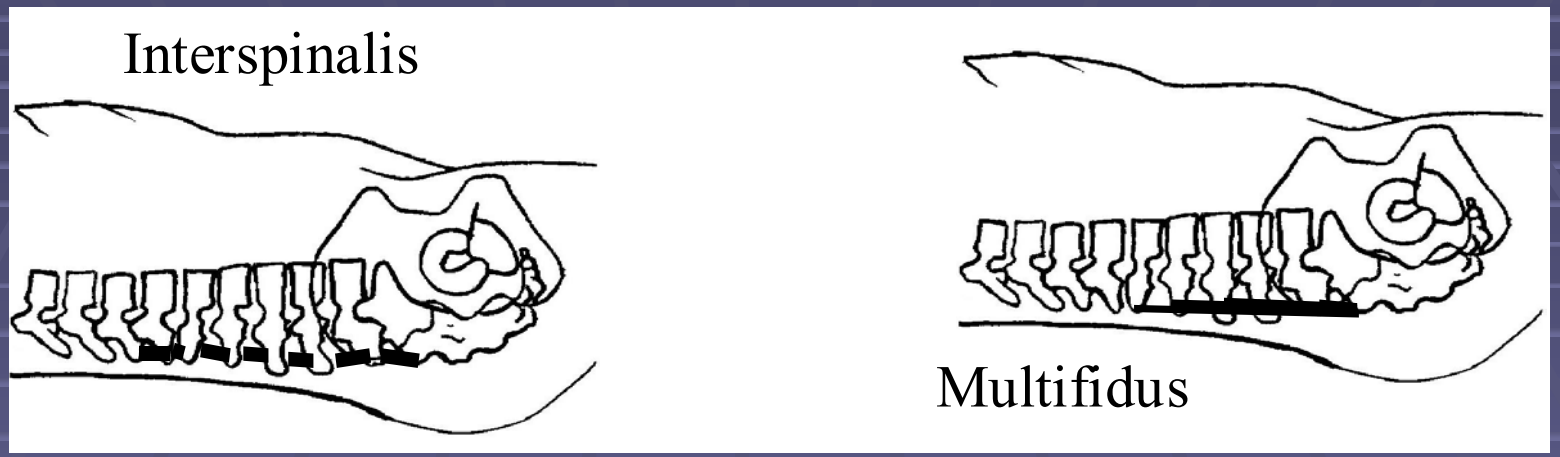


Diagrams from: True Plane Spinography 2nd Ed. Pettibon B, Harrison D, 1981.

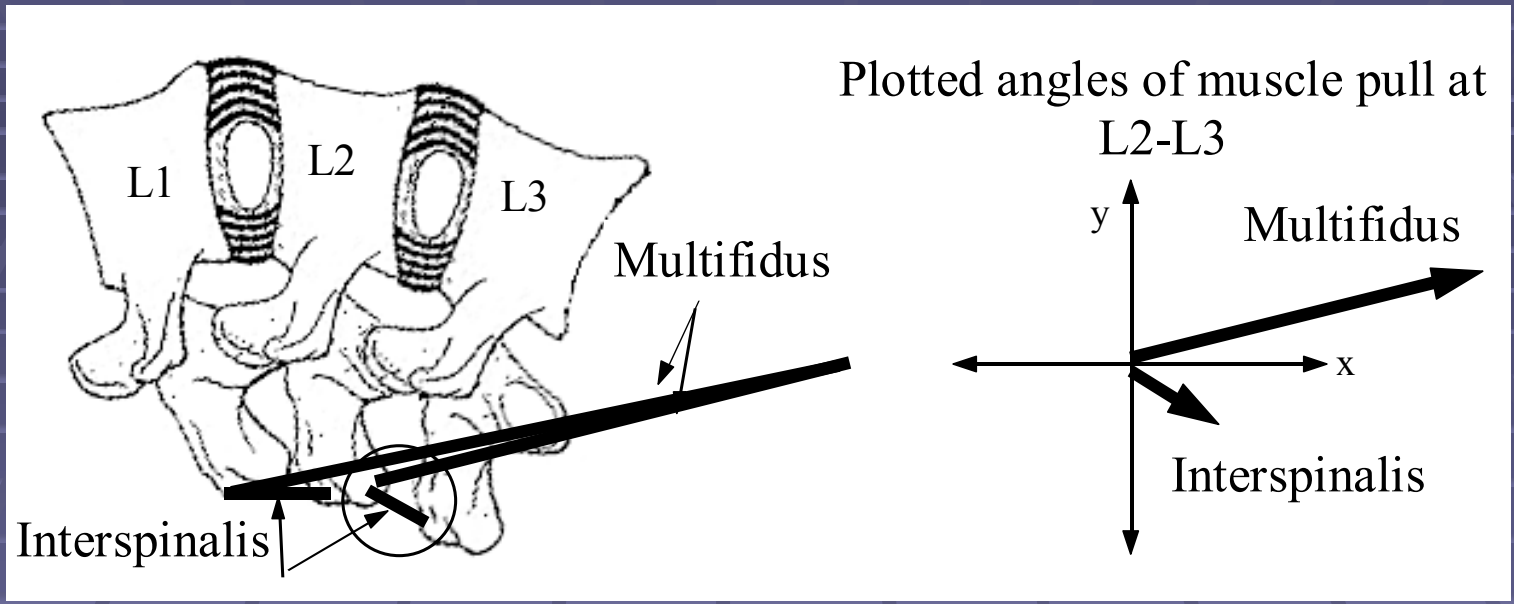




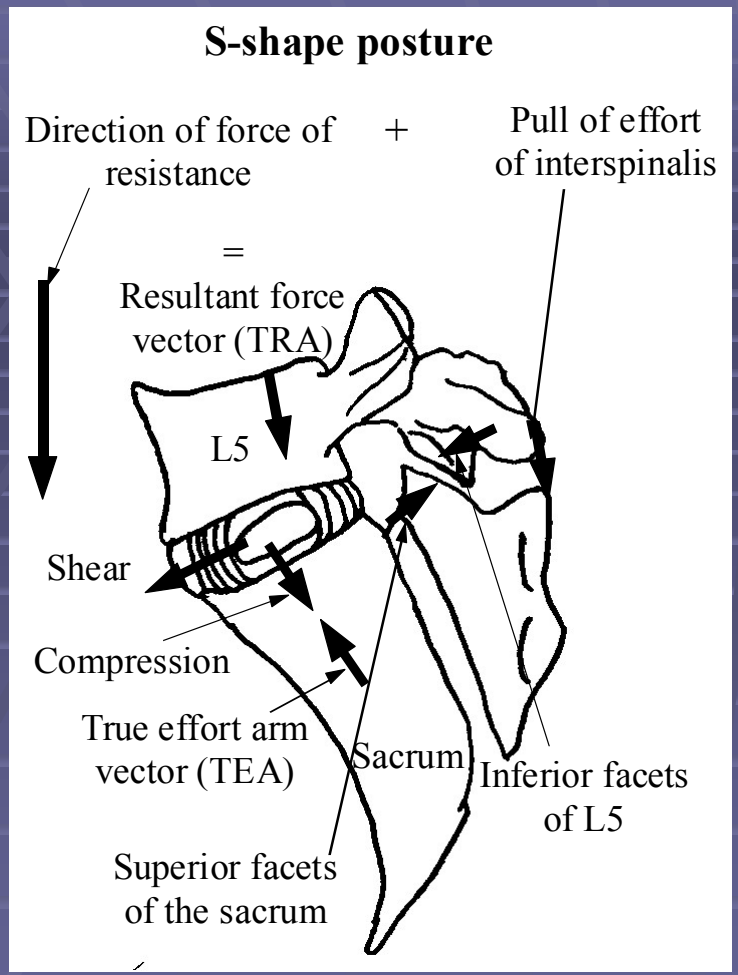
See how the body uses parts like the facets to stop shear forces.

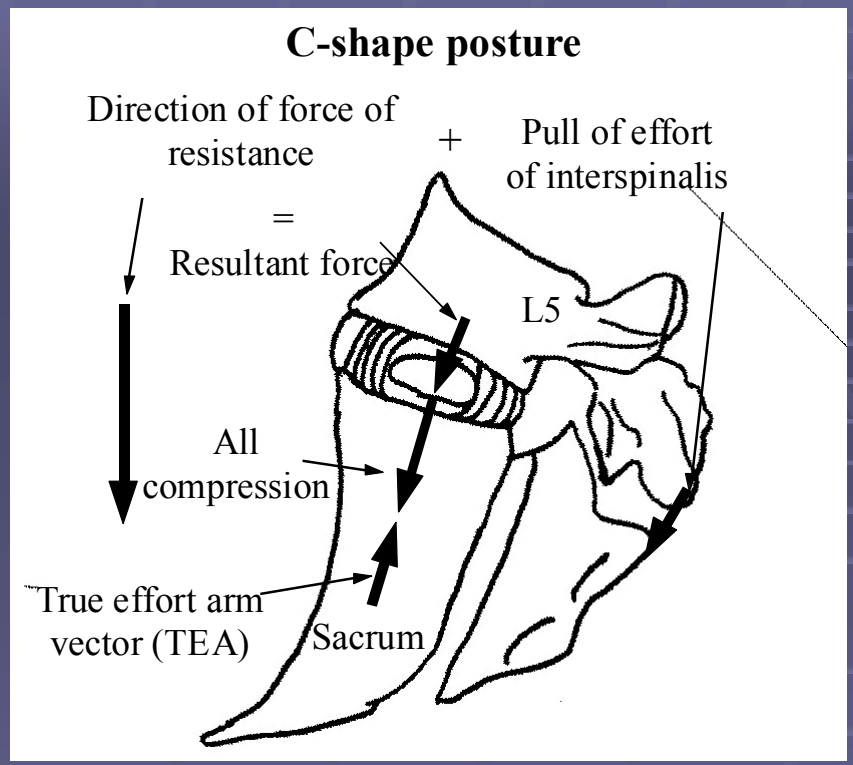


With co-contraction, see how muscles at first seem similar in function.



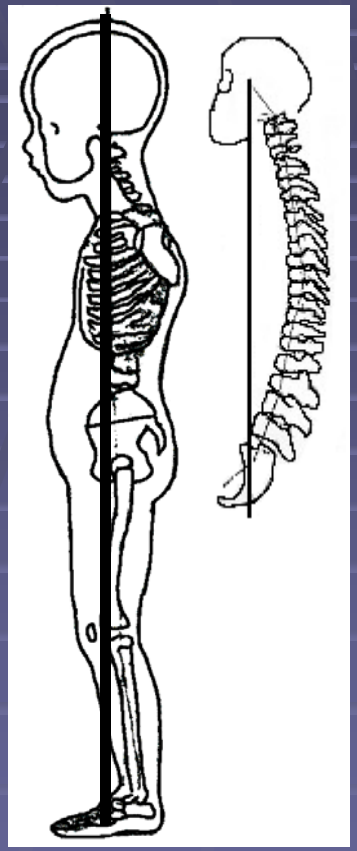
See the two muscles up close and when plotted, see how they provide different functions and which one is in position to provide co-contraction.



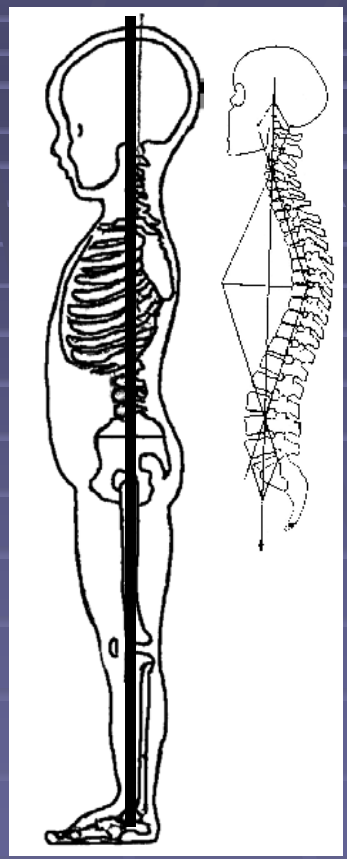


We compare two different postures and how the forces impact the joints differently.

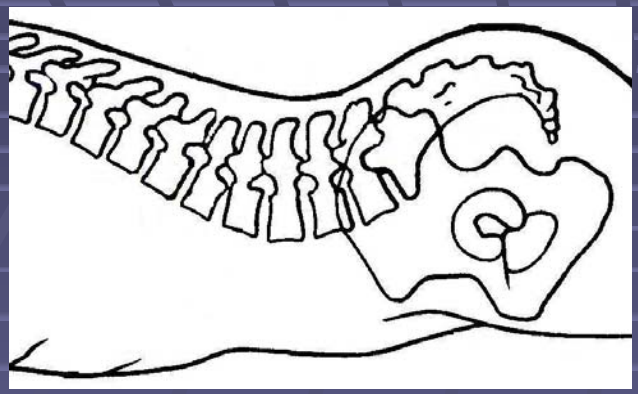
Improper Posture

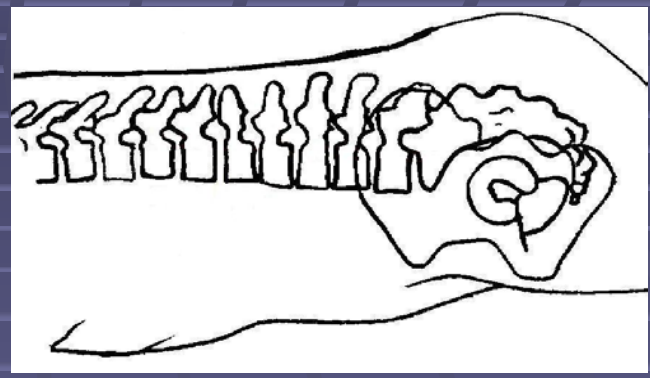


Proper Posture

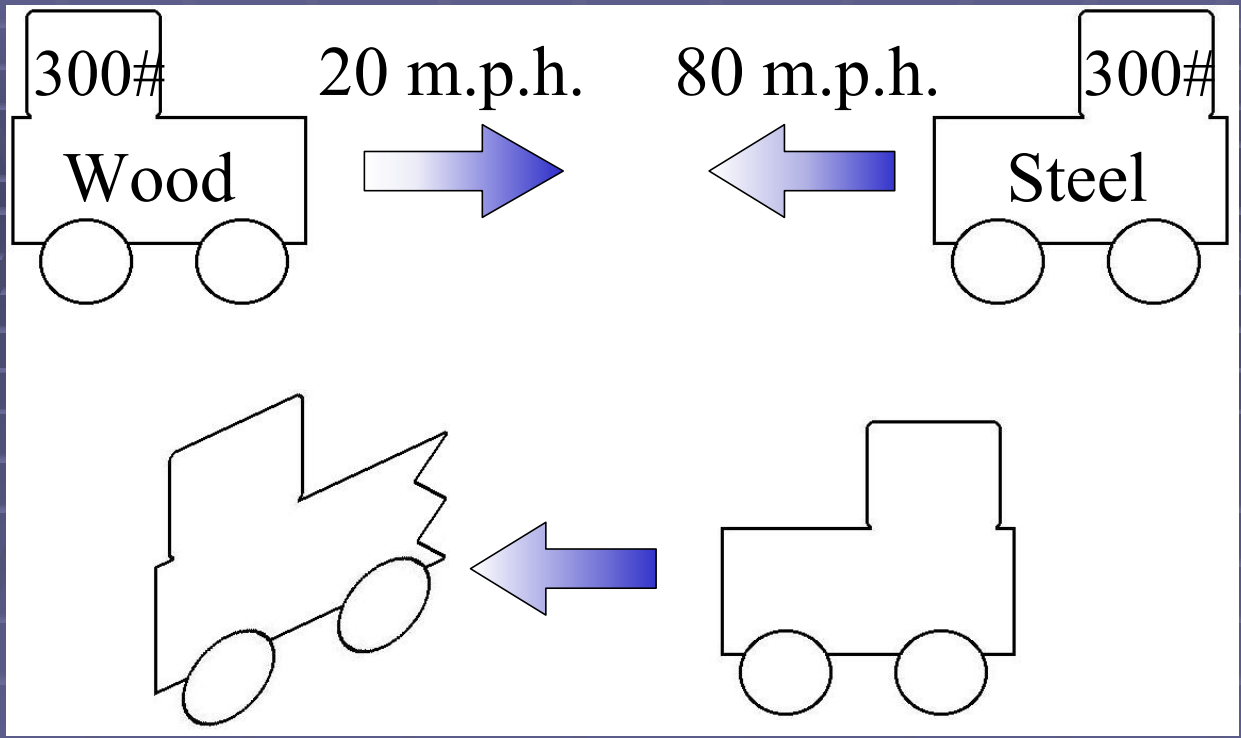


Begin to learn how these two postures perform in athletic events.

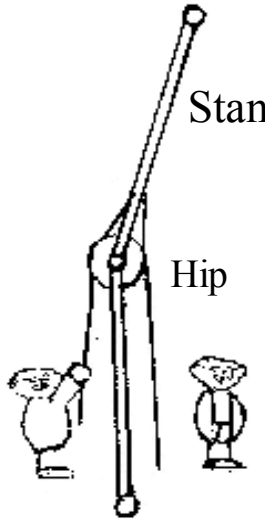




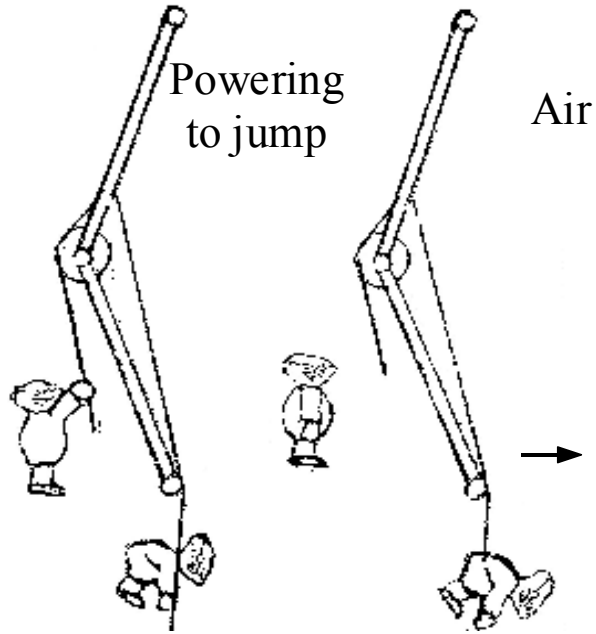
See how these two postures in a football stance will perform against each other and discover the one with strength.



See how proper posture will produce better momentum and better stability when it hits in football contact like this car going 80 m.p.h. and made out of steel.



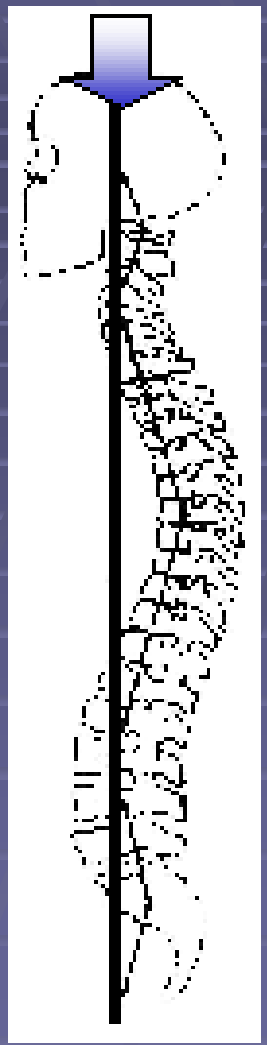
Trunk forward of axis of gravity: Imbalanced.



The muscle continues to work to move the lower trunk forward to stay balanced with the upper trunk.

See how poor posture creates a poor jumper who involuntarily jumps forward, not up.

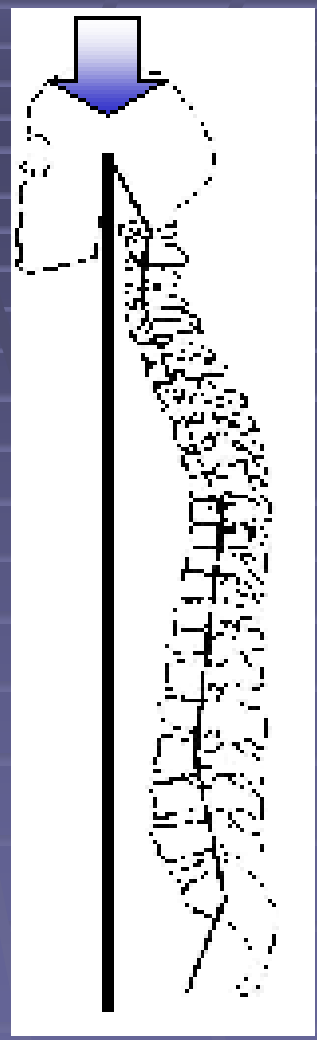
Center of mass



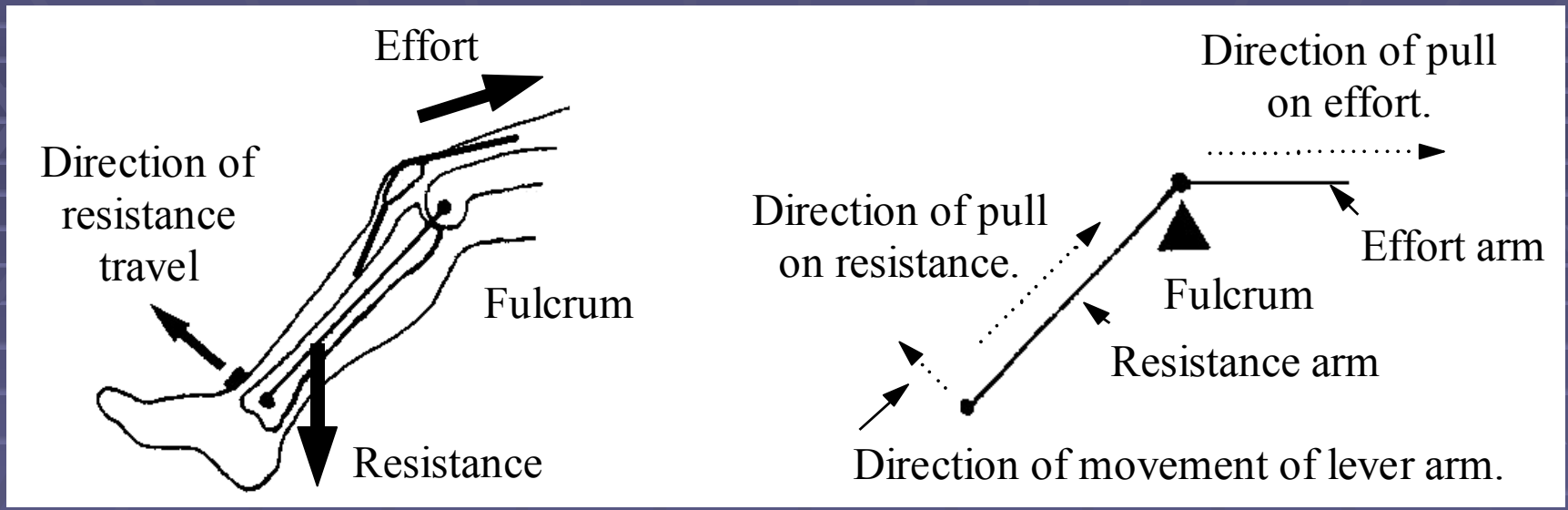
Proper Posture

Get an introduction into how the proper spine is in a minimum energy state conducive to fast twitch muscle fiber development while poor posture is conducive to slow twitch fiber development.

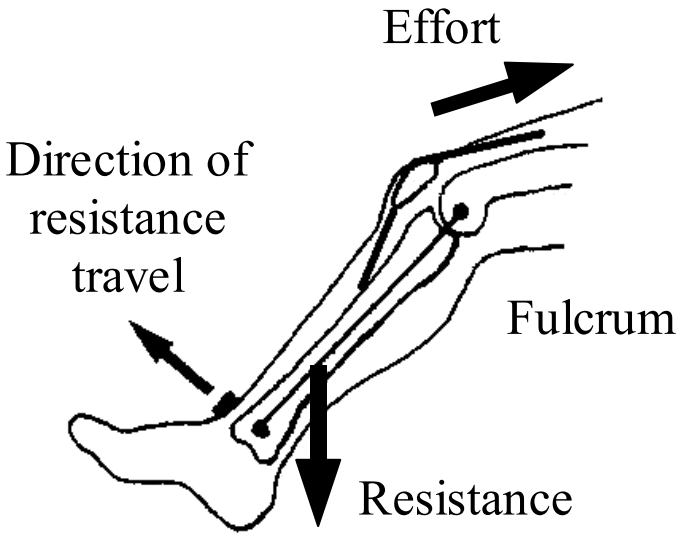
Center of mass

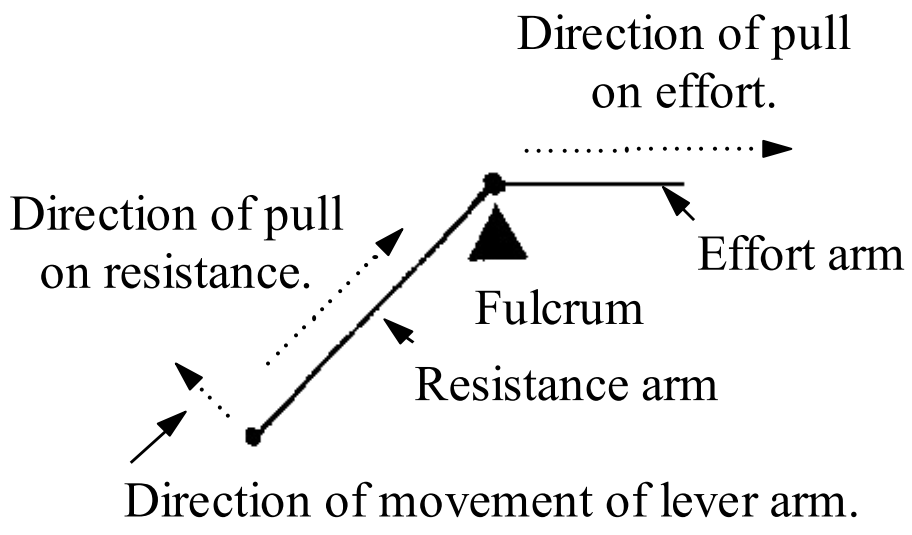


Poor Posture

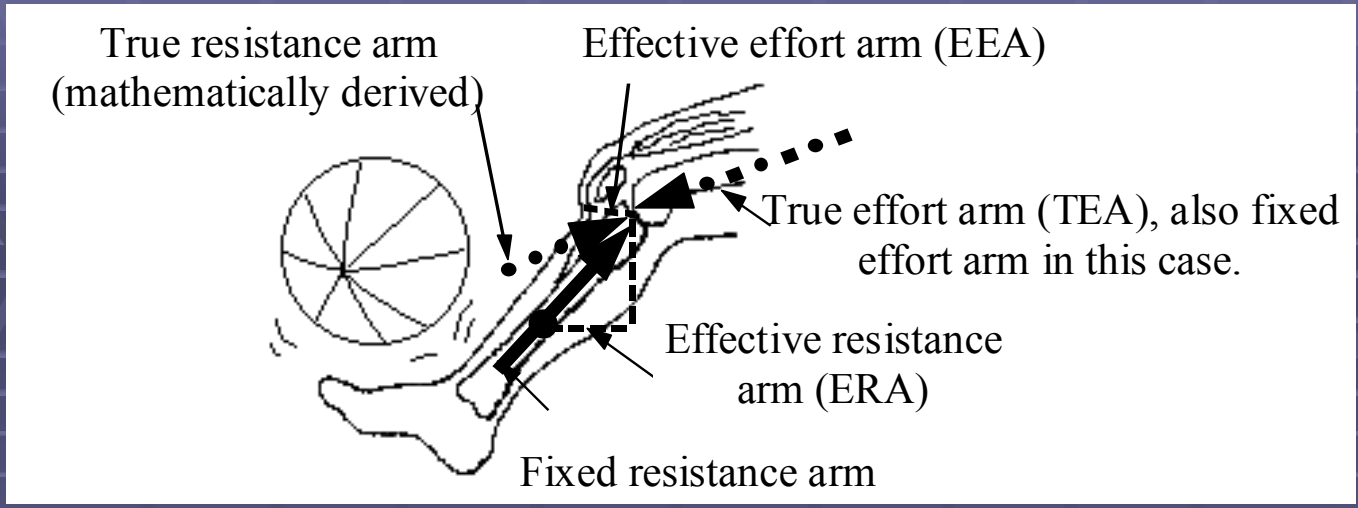


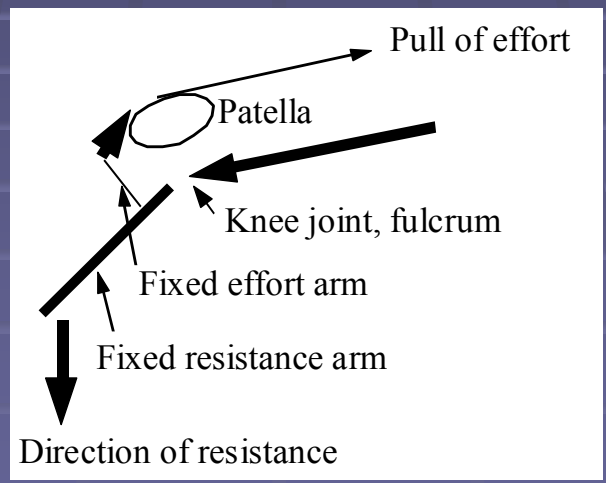
Begin to be able to identify leverage components in human movement.





See how applying the current 3 classes of levers to movements like the leg extension creates controversy and has no true answer.



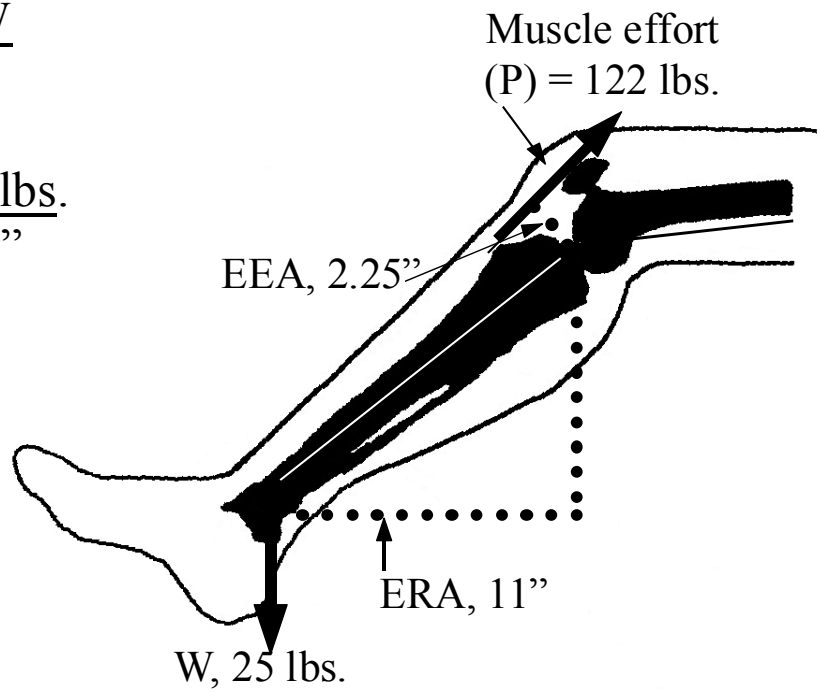


See how leverage identification will lead to a true functional identification of what a lever system is.

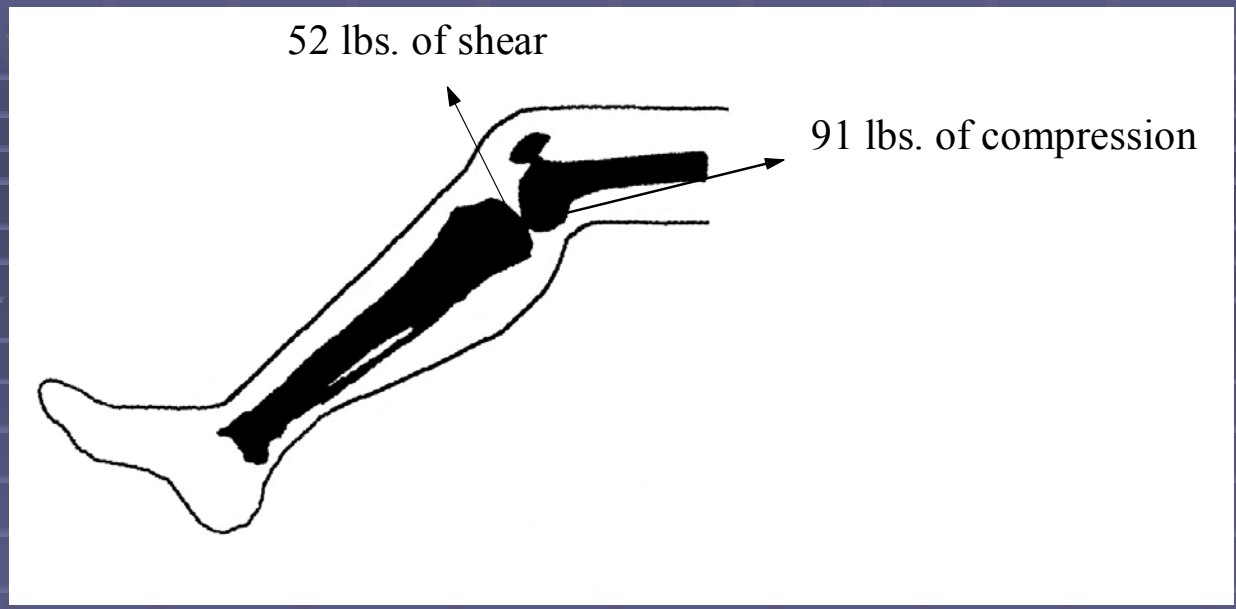
$$\text{Effort (muscle pull, P)} = \frac{\text{ERA} \times \text{W}}{\text{EEA}}$$

$$= \frac{11\text{”} \times 25 \text{ lbs.}}{2.25\text{”}}$$

$$= 122 \text{ lbs.}$$



See how to actually apply leverage mathematics.



Learn how leverage mechanics reveals what is happening at a joint in an exercise and what type of functional lever is in place (1st or 3rd).

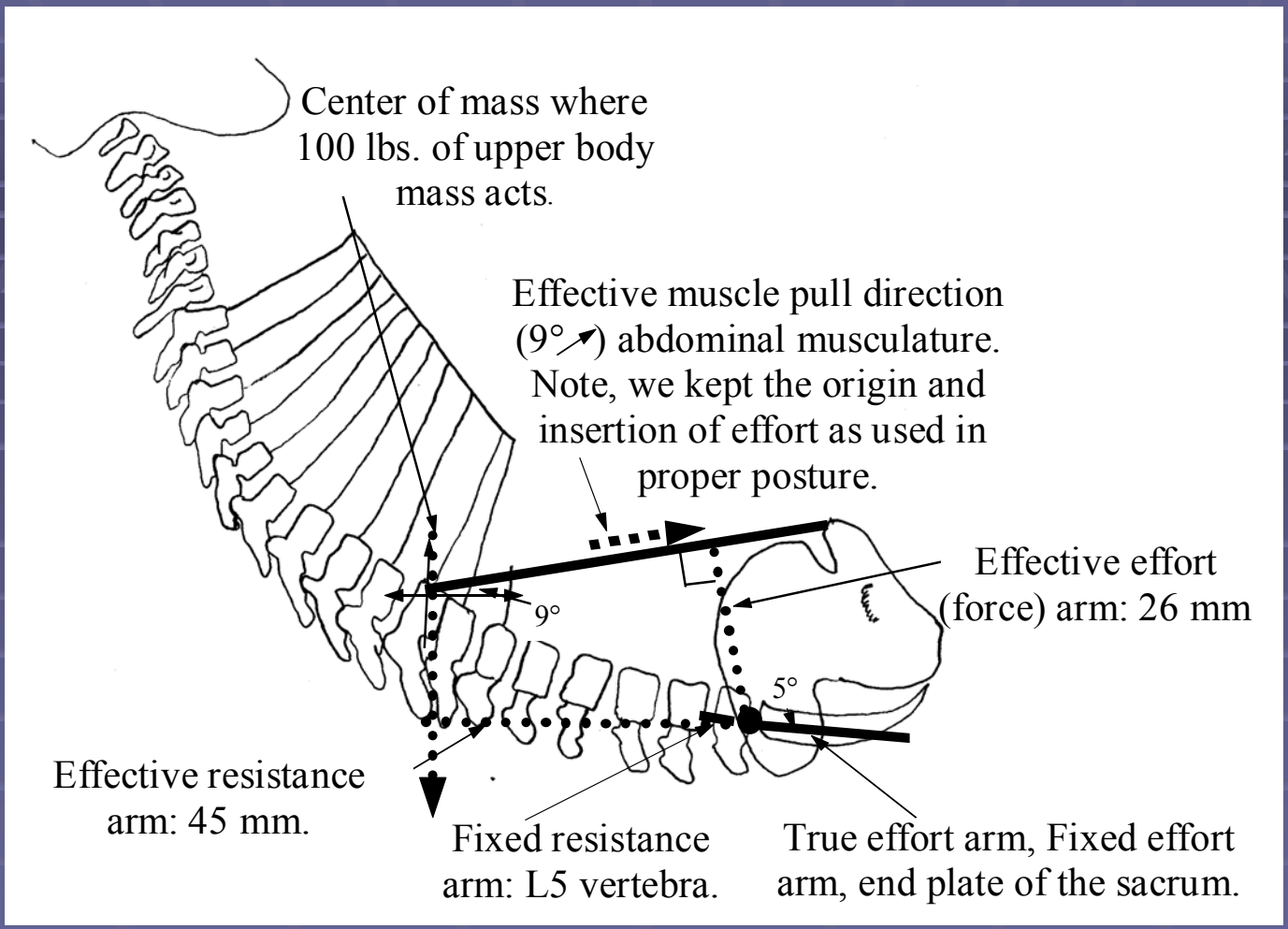
This leg extension will really get you in shape!

This leg extension equipment will get you in shape!

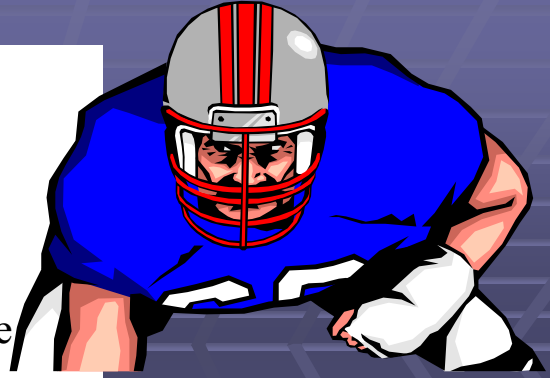
Learn, in this case in the leg extension, that shear is stopped by the ACL, but you are not told this.

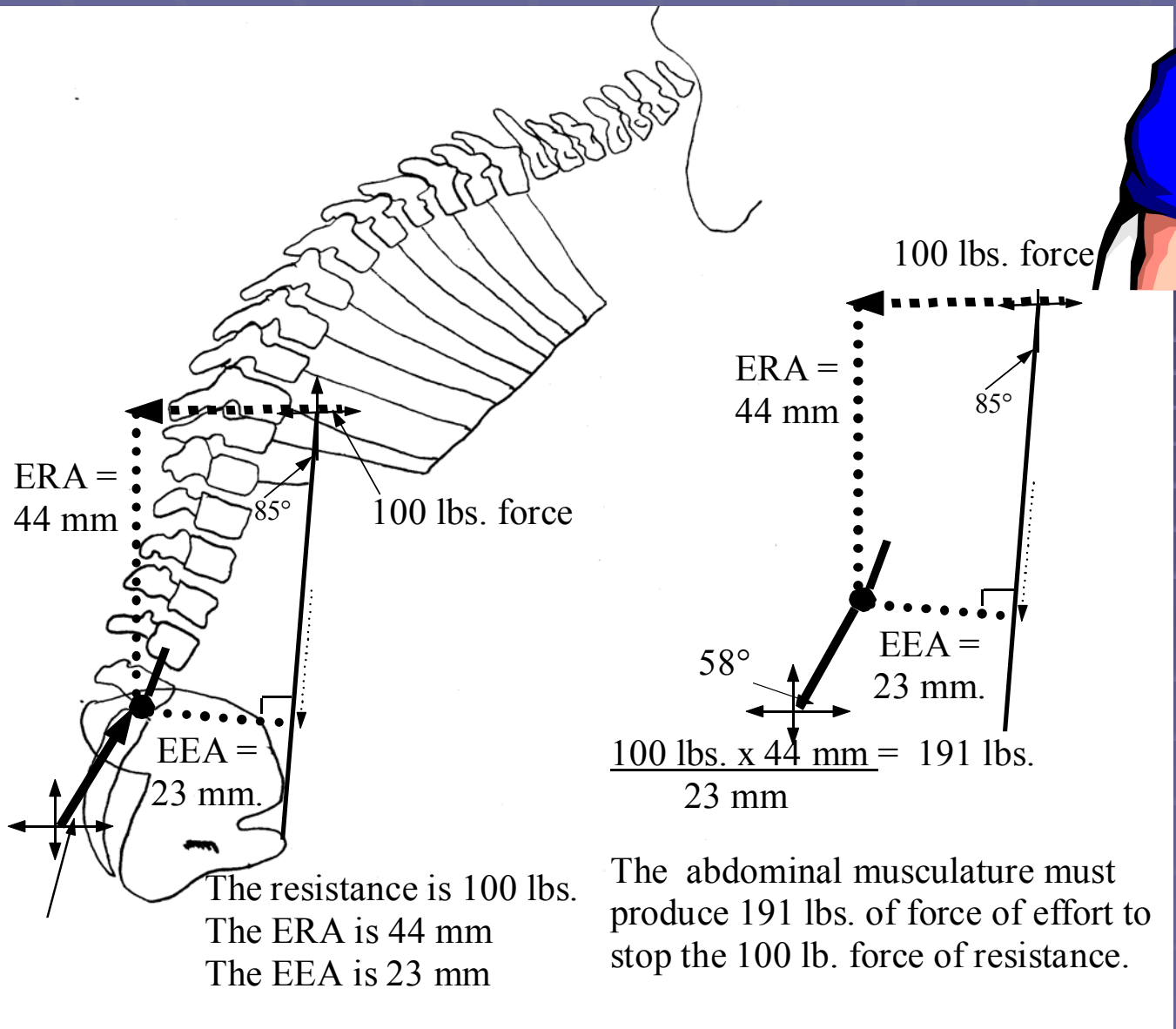
How does that exercise impact my anterior cruciate ligament? If it strains my ACL I might not want to do the exercise.

Learn in the future how an exercise impacts your joints – something you want to know.



Get an introduction in identifying leverage components in the complicated spinal movements.



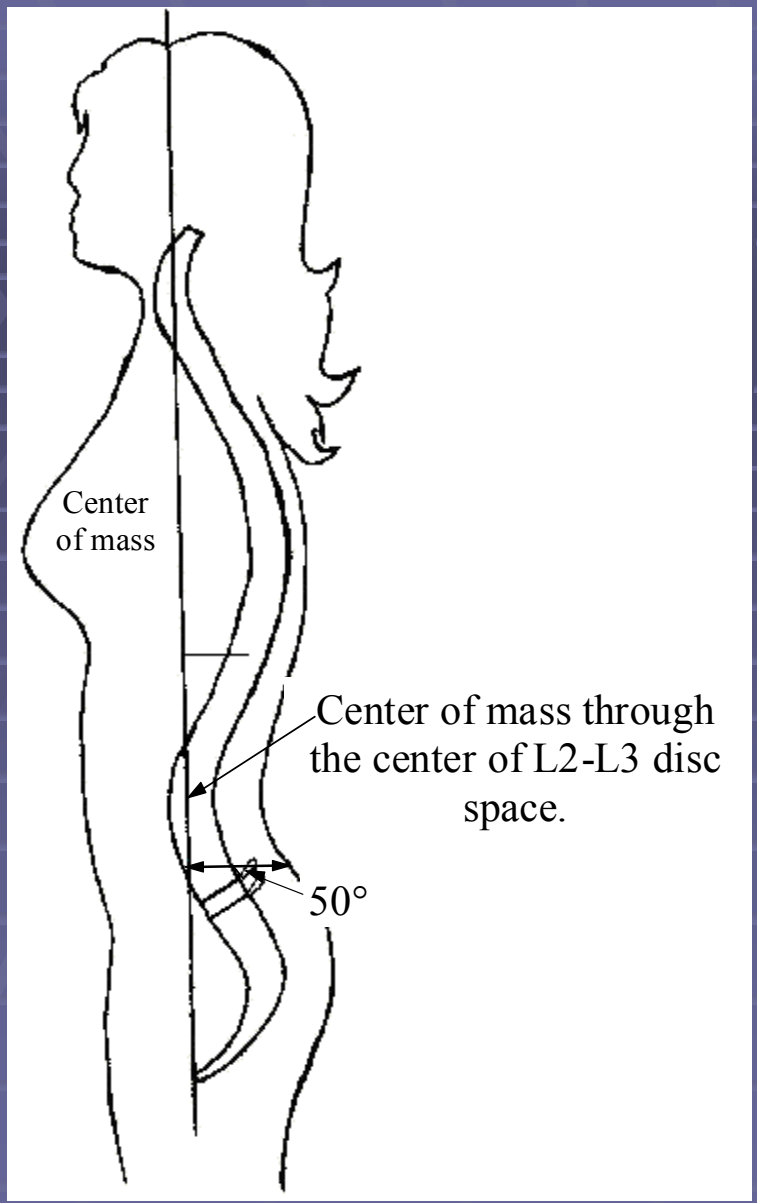


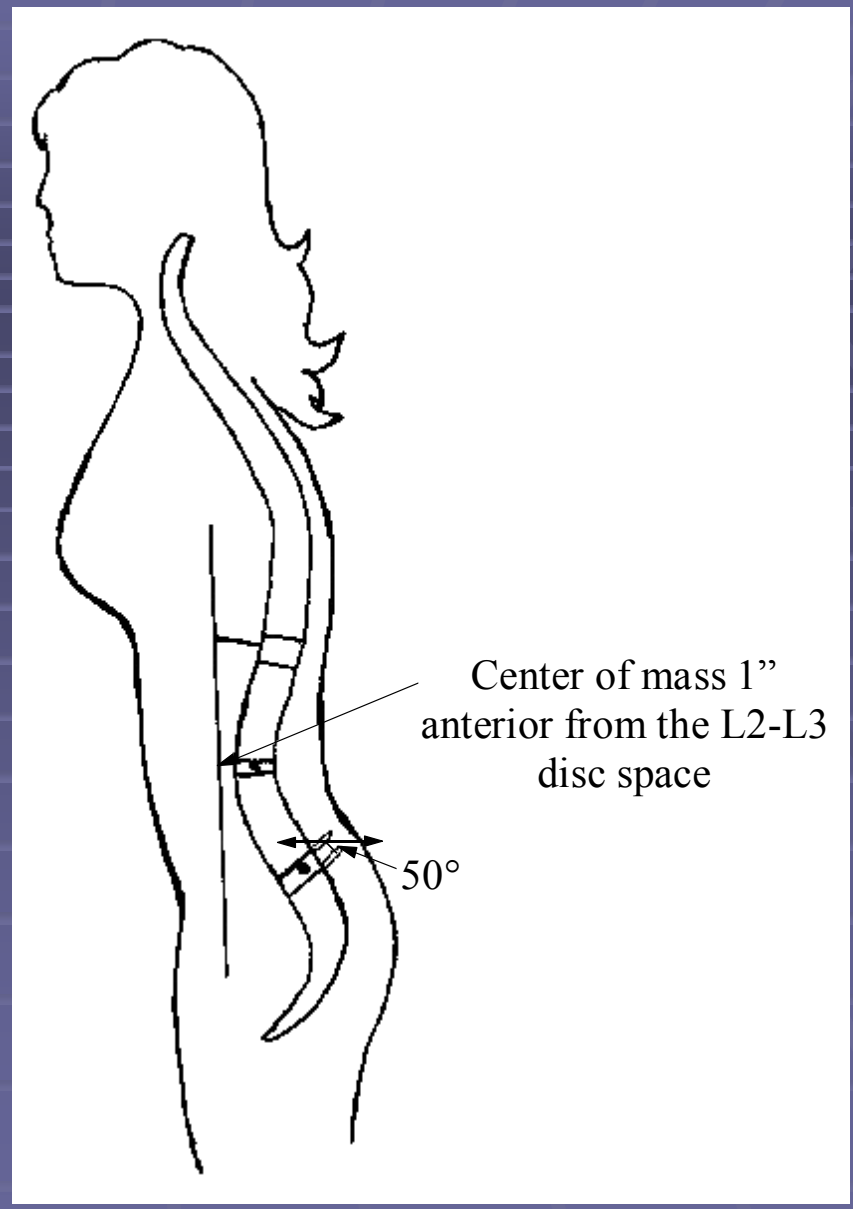
The resistance is 100 lbs.
The ERA is 44 mm
The EEA is 23 mm

$$\frac{100 \text{ lbs.} \times 44 \text{ mm}}{23 \text{ mm}} = 191 \text{ lbs.}$$

The abdominal musculature must produce 191 lbs. of force of effort to stop the 100 lb. force of resistance.

Get an introduction to setting up leverage evaluation of complicated spinal movements.

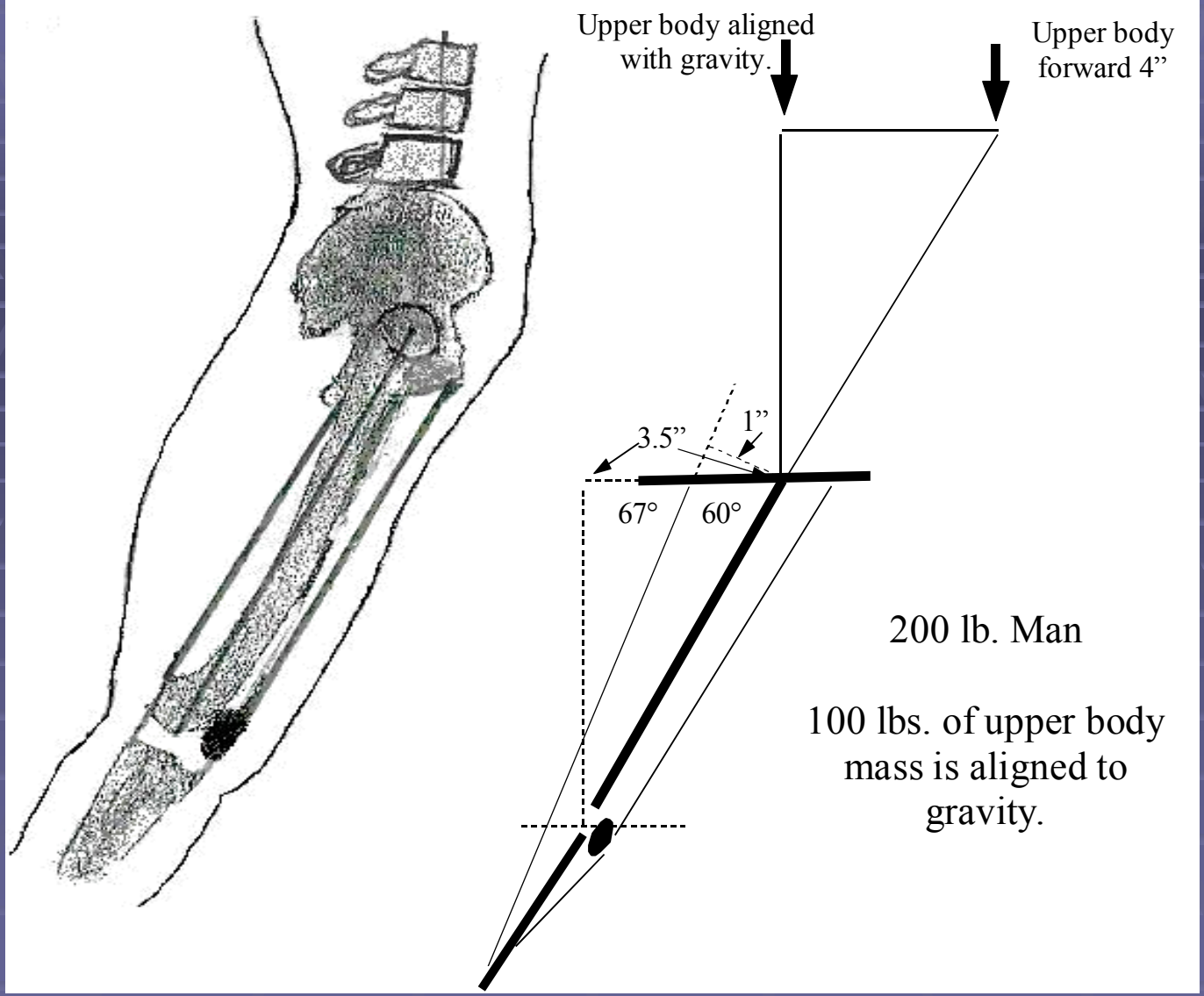




See how different postures create different leverage at a joint and the forces created into the joint.

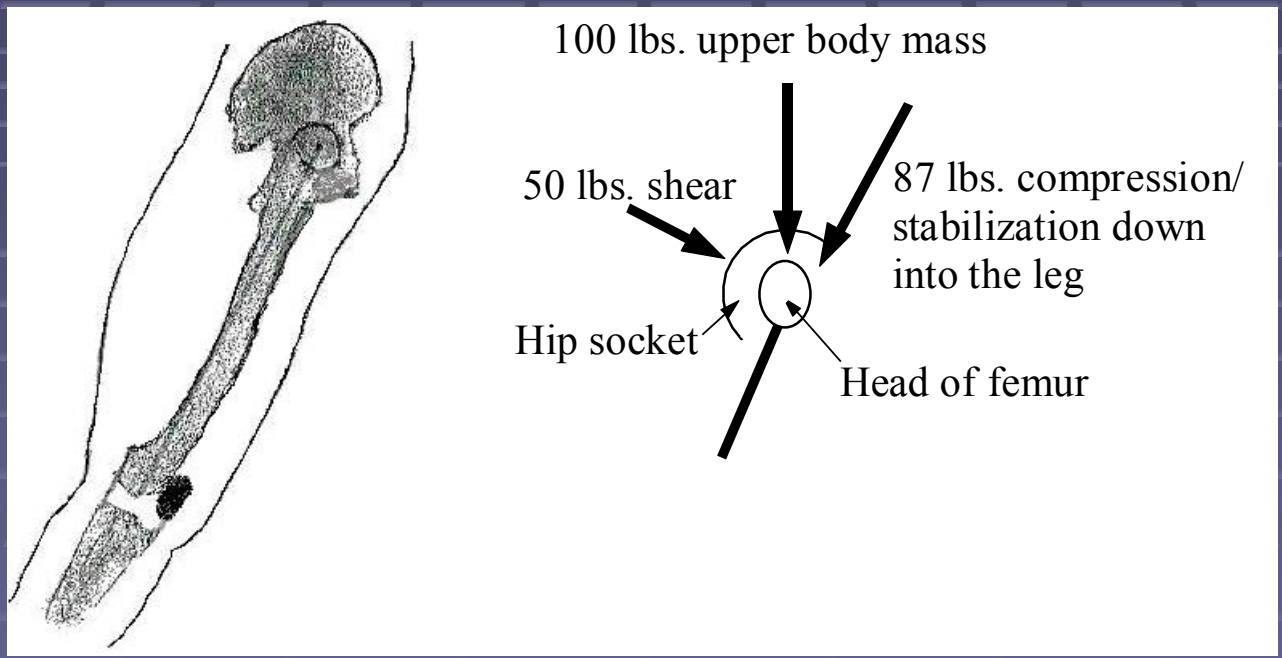
	Normal S-curve posture	1” Anterior S-curve posture	S-shape center of mass through L5-Sacrum	Reverse Curve Posture
L5-Sacrum	134 lbs.	186 lbs.	60 lbs.	92 lbs.
Compression	130 lbs.	184 lbs.	48 lbs.	92 lbs.
Shear	32 lbs.	29 lbs.	36 lbs.	2 lbs.

After the mathematics of leverage is determined, see how the joint is affected.

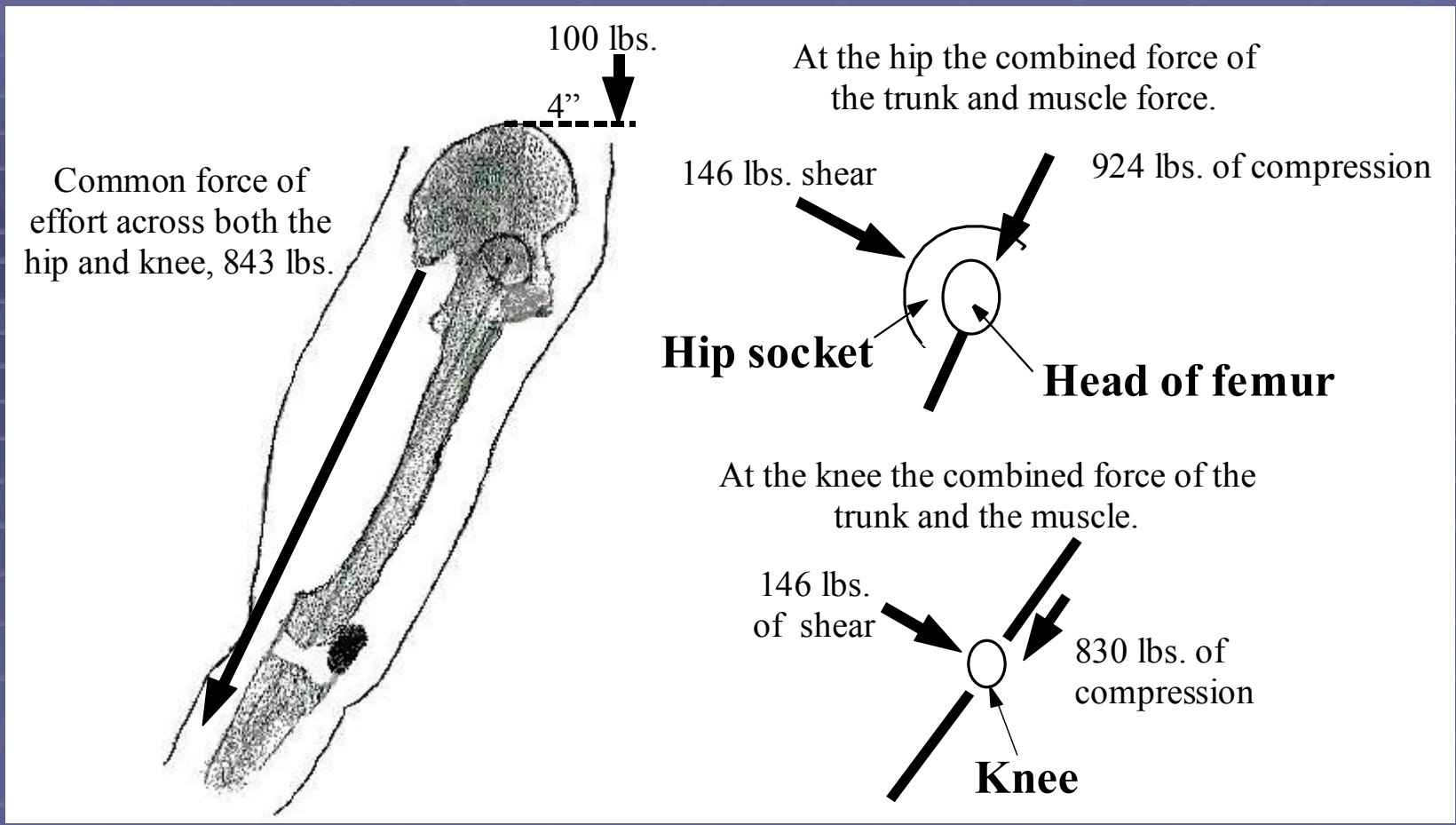


Get an introduction into leverage set up to examine locomotion with proper and improper posture.

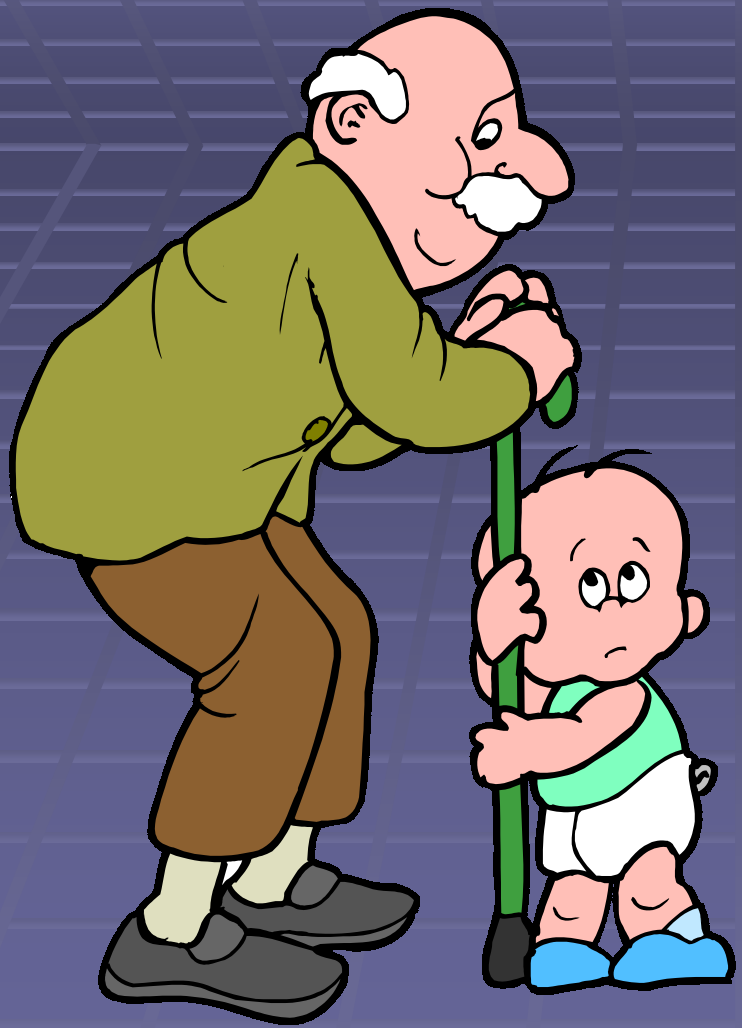
Leg and forces at the hip.



See how good posture creates good locomotion.



See how poor posture will adversely affect the hip and knee and cause poor locomotion.



Review of how young people must develop good spinal structure to be good physically and why older people must keep good posture to stay physically healthy.