



The “SPINAL ENGINE” Meets

The “BICAMERAL FOOT”

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BIPEDAL GAIT



“BARBIE DOLL” GAIT



3-DIMENSIONAL DISPLACEMENT of
TRUNK AND HEAD



HUMAN BIPEDAL GAIT

HEAD and TRUNK move through space
SMOOTHLY through a SAGITTAL PLANE



EFFICIENCY

Most EFFICIENT WALKERS

Most ADEPT ENDURANCE RUNNERS

ROTATE OUR BODY around a VERTICAL AXIS

All use same biomechanical features

SURVIVAL and COMPETITION!!

A malfunction in any biomechanical feature
leads to a response from **CNS** to
MAINTAIN EFFICIENCY!!

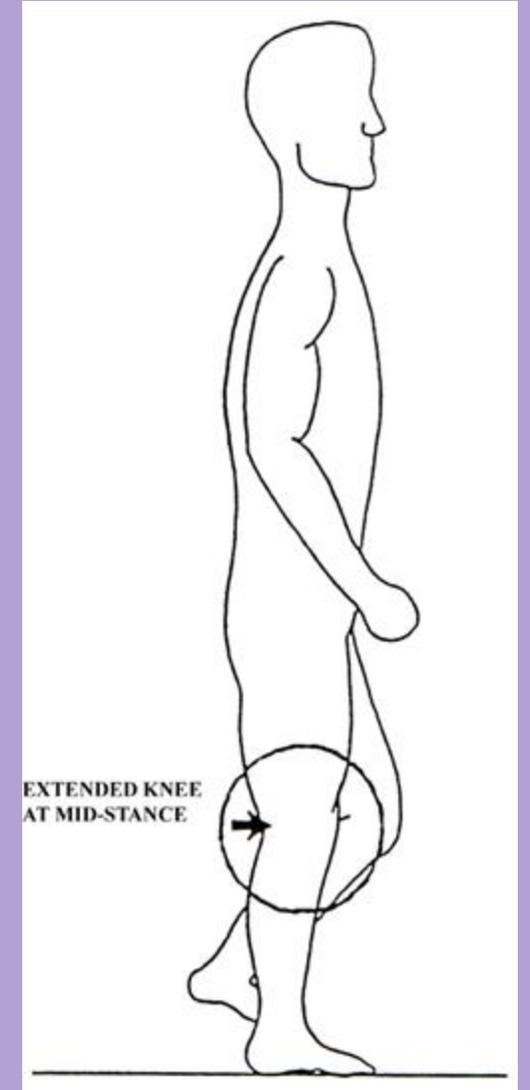
SILENT CULPRIT* vs *NOISY VICTIM

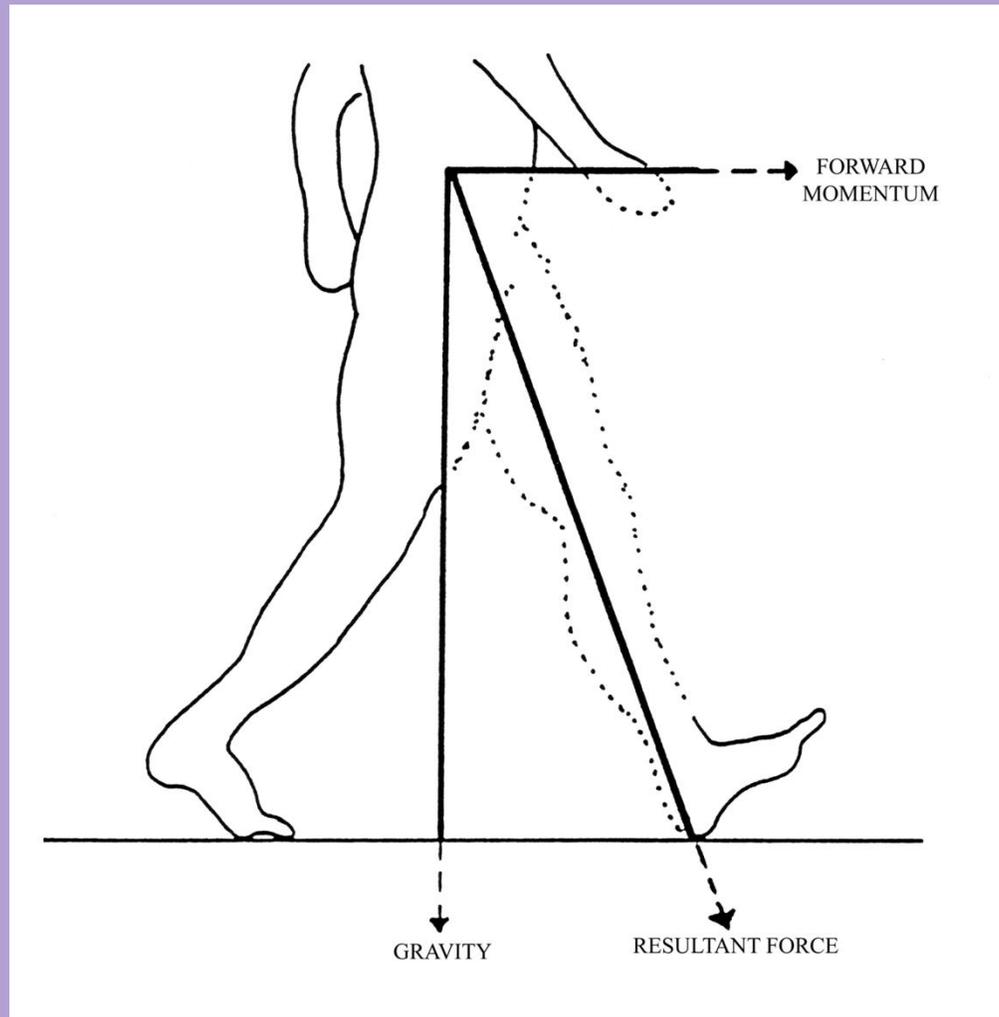
Example: Inversion subtalar fixation (eventual silent culprit) leads to painful midtarsal joints; hallux valgus; possible stress fracture of the tibia!

Initiation of gait is *expensive* in terms of muscle activity

After first steps *pendulum* motion ensues. Maintained by the 'Spinal Engine' (Psoas)

Let's look at gait *once initiated* e.g., right leg in mid-stance phase with left leg in swing through





Heel Strike Corresponds to Resultant Force Vector
This is WHY there is a TYPICAL Gait Speed between 2-3 mph



The SPINAL ENGINE

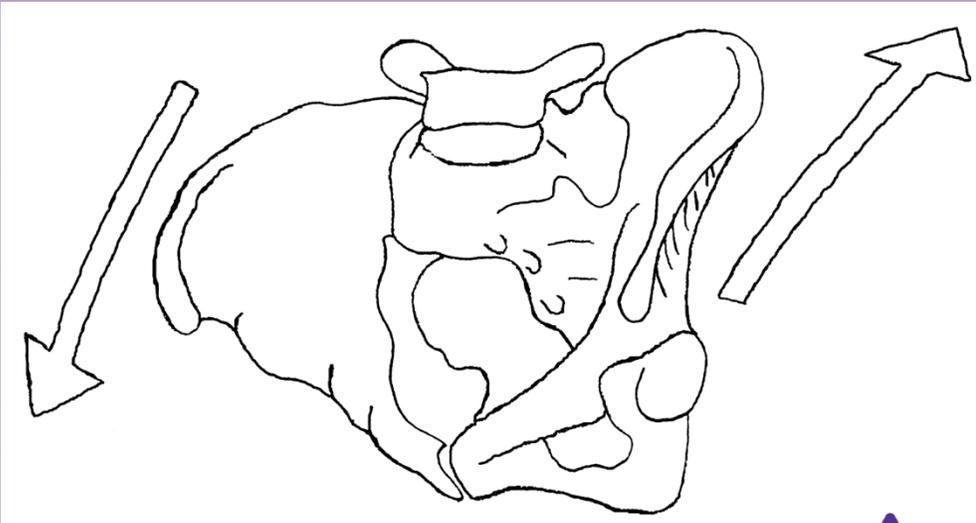
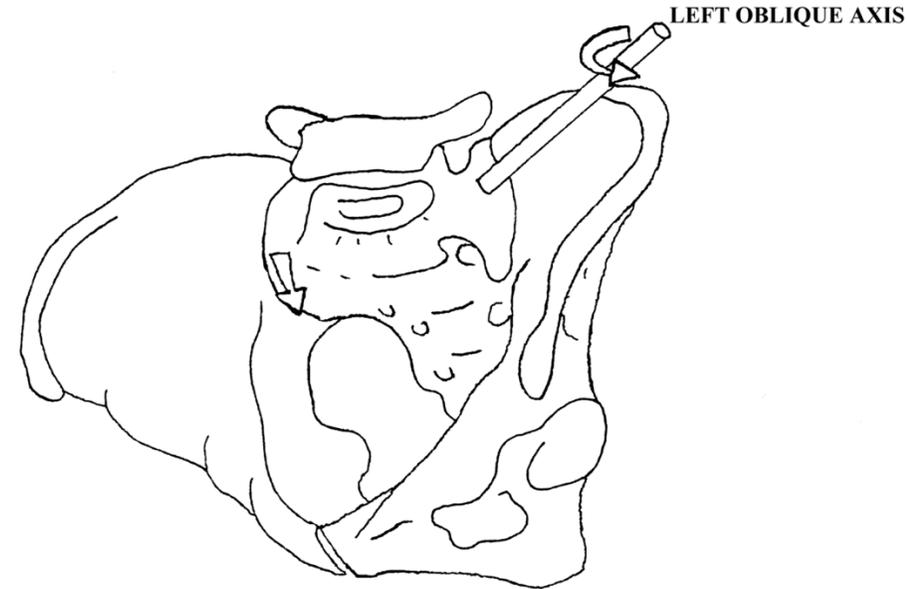
As right hip extends from neutral, the right psoas changes from ***eccentric to isometric*** action

Reversed origin and insertion

Psoas pulls lumbar spine into extension, left rotation, right side bending

Pulls ***sacrum*** into an ***anterior torsion*** (left on left)

At the same time, ***left hip, in swing through*** phase creates a ***posterior torsion*** (right on left)



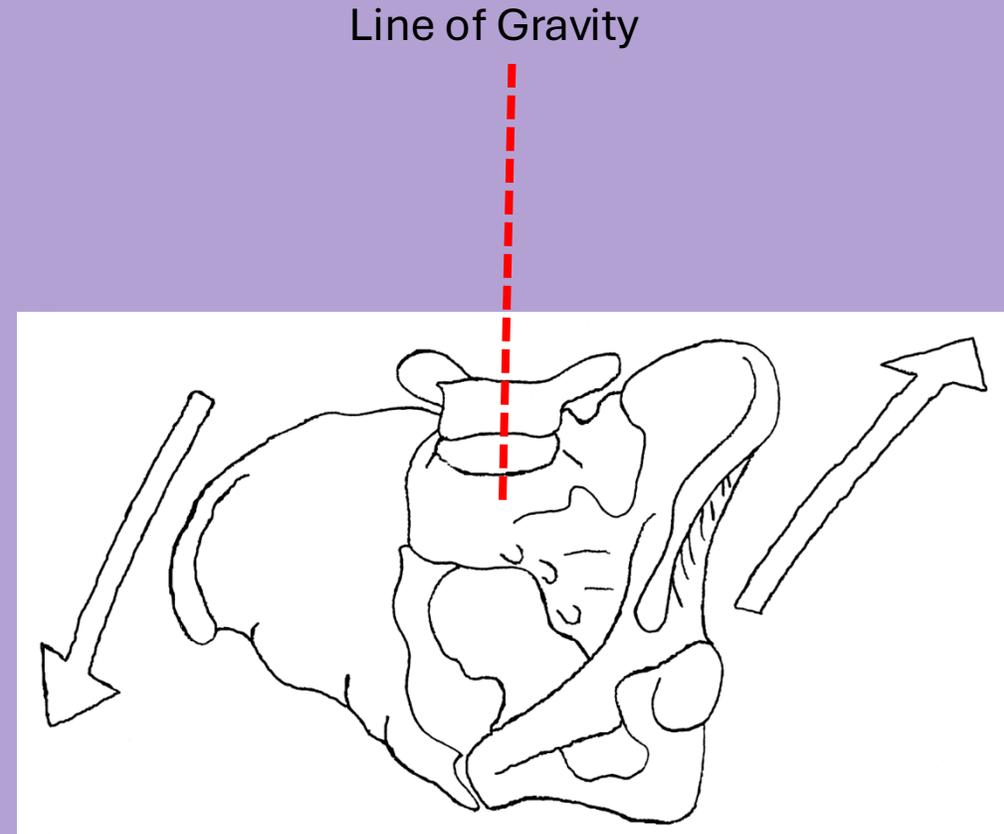
RESULTANT AXIS is **VERTICAL**

VERTICAL AXIS of ROTATION of
THE SPINE

Now TRAVELS from the **SACRUM**
(COG)
to the FORAMEN MAGNUM

VIA T/L JUNCTION SPINE
ROTATES **THROUGH** the RIB
CAGE

and ROTATES C/V JOINTS **FROM**
BELOW UP



The “LIMB ENGINE”

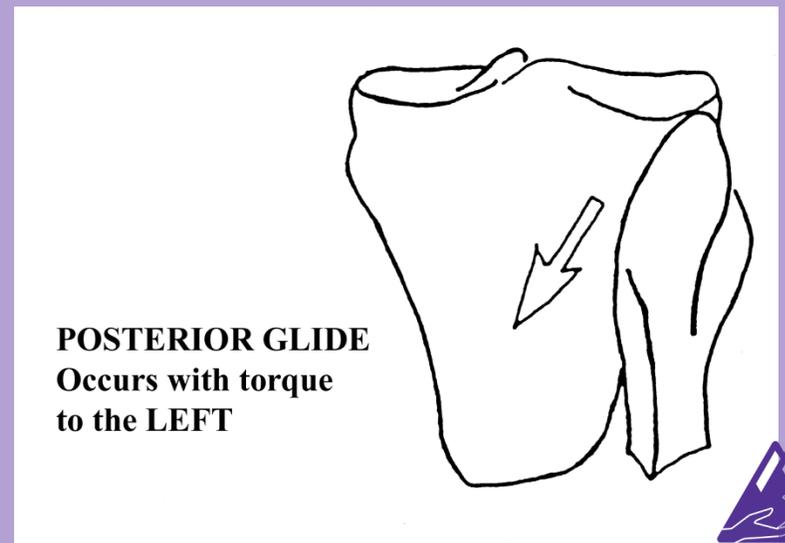
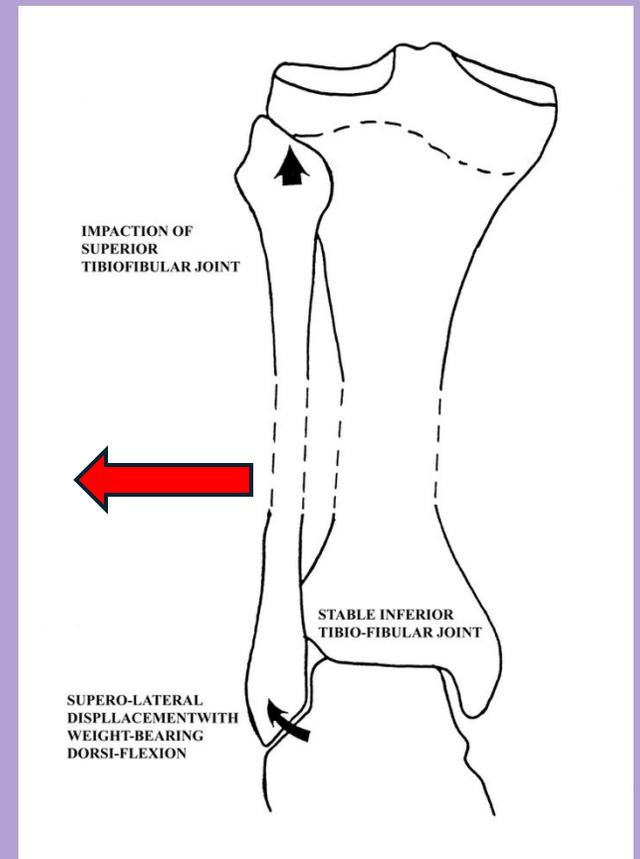
As the right hip ***extends, it internally rotates***

To prevent energy loss through ground ***friction,***

ALL joints ***distal*** to the hip close pack with ***external rotation***

Potential kinetic energy now stored in ***peripheral joint capsules and ligaments***

The ***fibula bows*** and glides ***posteriorly at the superior tibiofibular joint***

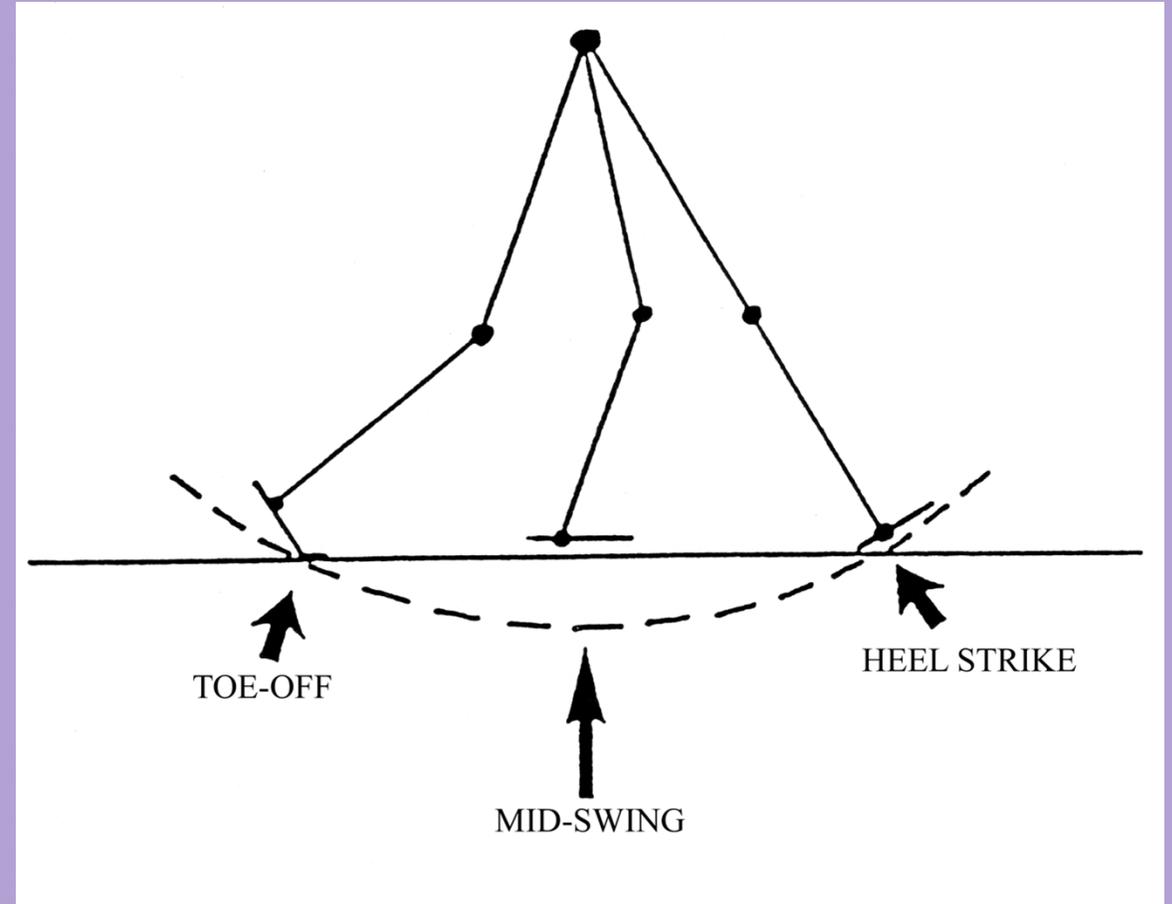


At right heel lift

Together with the stored potential kinetic energy within the ***SPINAL ENGINE***

The ***pendular right limb*** is projected forwards into the swing through phase

Ready for ***load transference***

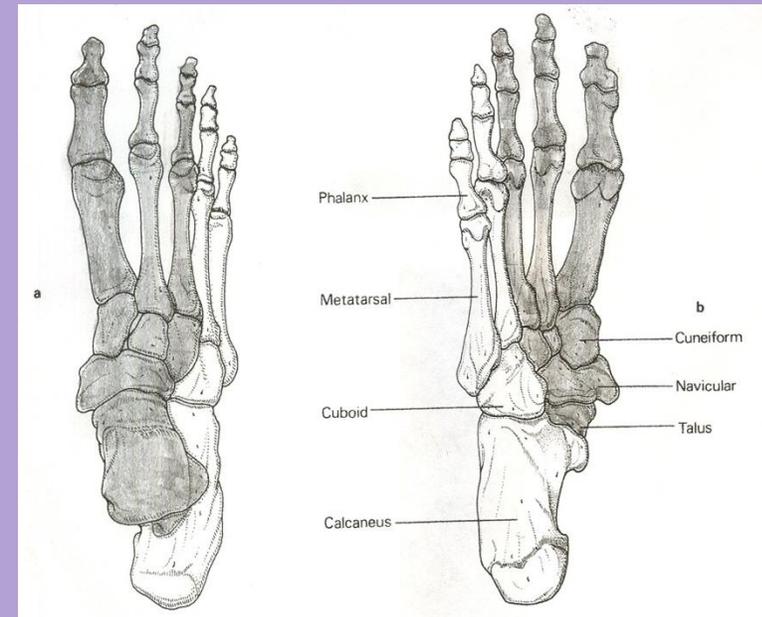
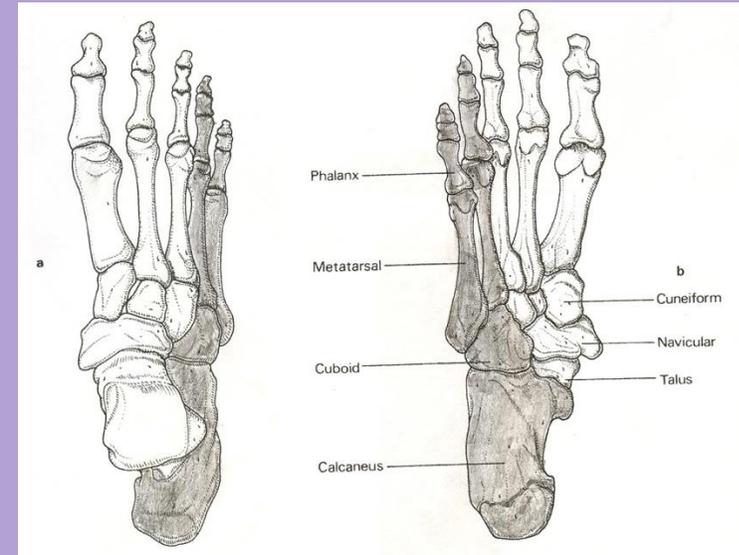


The BICAMERAL FOOT

Bicameral = *two separate functional parts*

The *human foot* has two separate functional parts

A *lateral* foot and
A *medial* foot



THREE FOOT PHASES of GAIT:

1) LATERAL FOOT PHASE

2) LOAD TRANSFERENCE PHASE FROM LATERAL TO MEDIAL FOOT

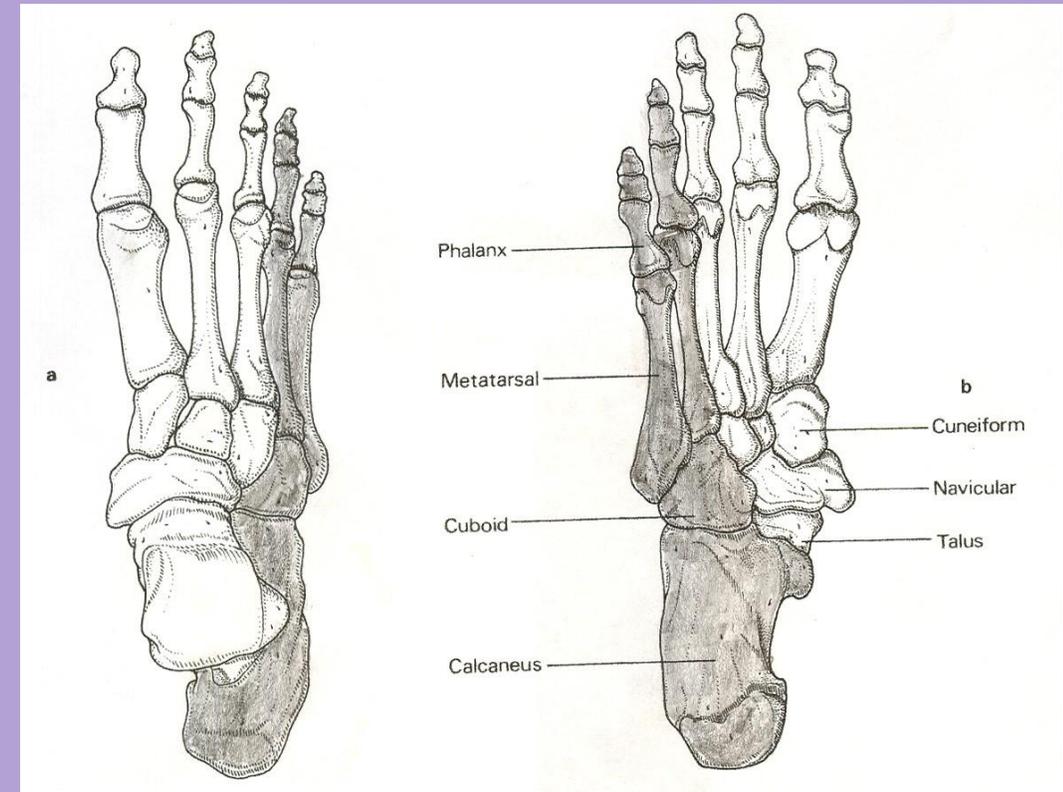
3) MEDIAL FOOT PHASE

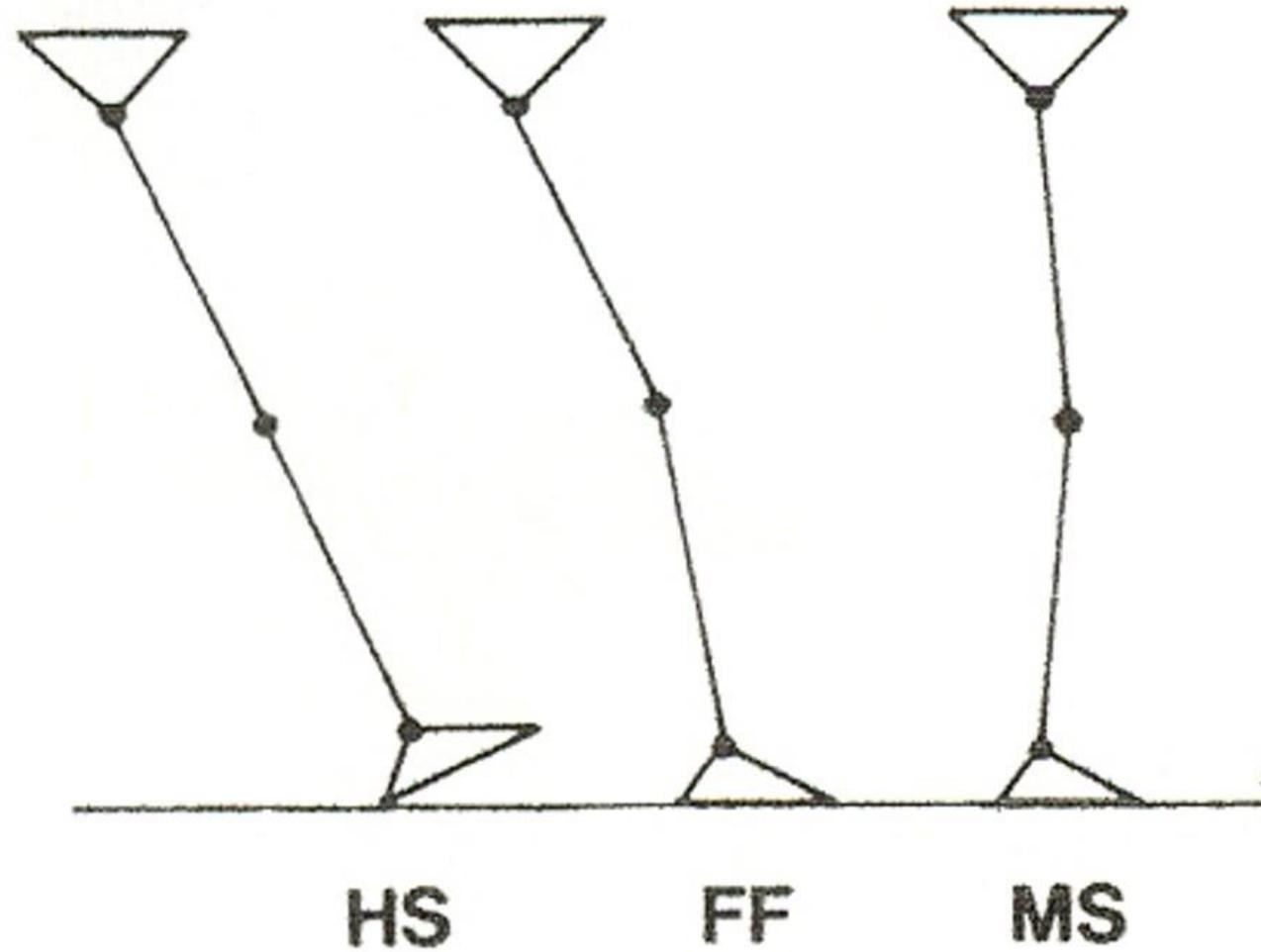
LATERAL FOOT PHASE

Lateral foot includes the ***subtalar, calcaneocuboid joints and 4th and 5th rays***

Absorbs ***impact at heel strike***

Absorbs weight transference between ***heel strike and mid-stance***





Lateral Foot Phase



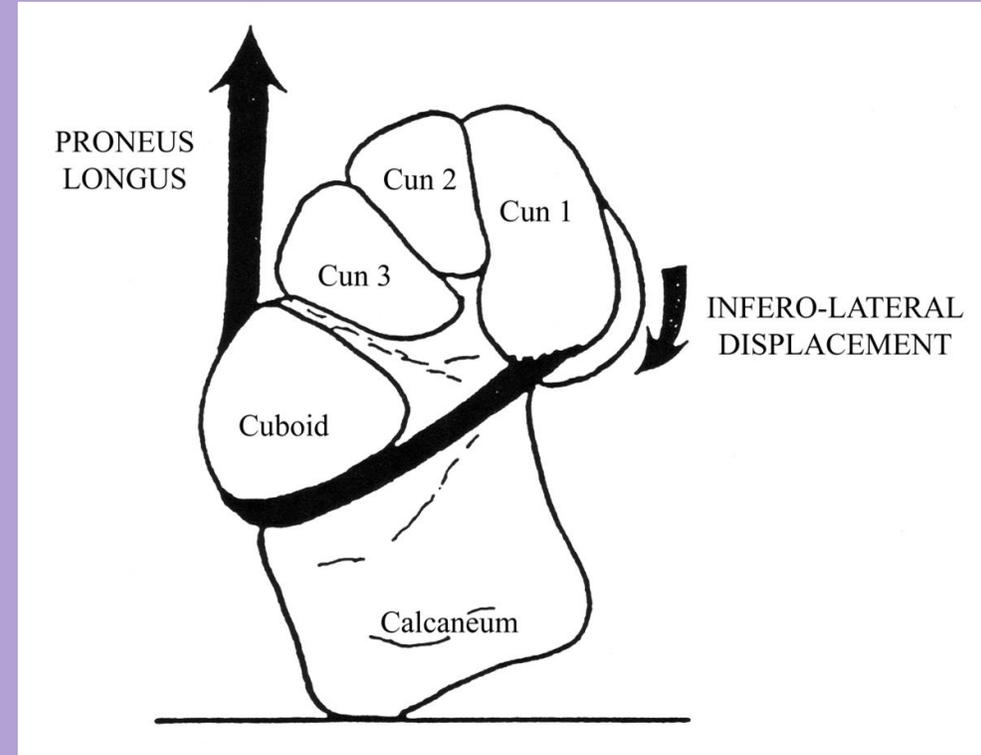
LOAD TRANSFERENCE PHASE

As Lateral Foot close packs
(including tibiofibular joints)

Peroneus longus pulls 1st ray to the
ground, ***setting the sesamoids for***

***Weight transference to the medial
foot***

Transference phase occurs between
midstance and heel lift



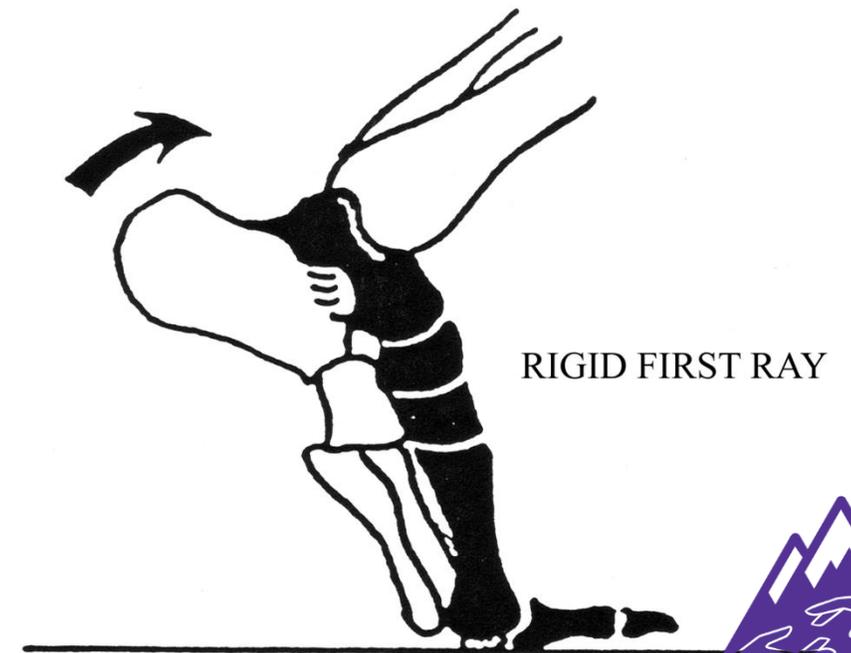
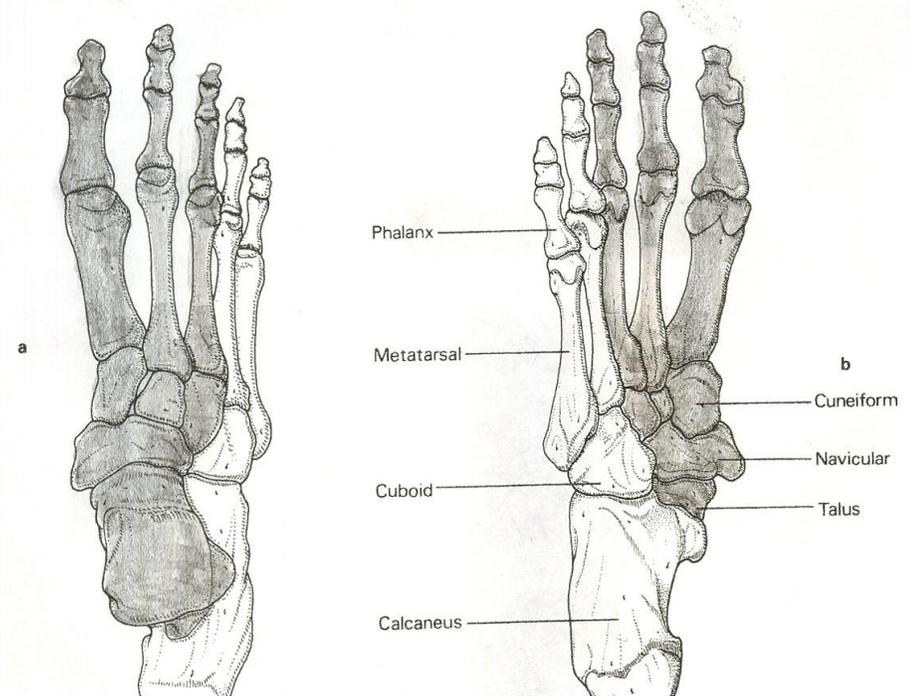
MEDIAL FOOT PHASE

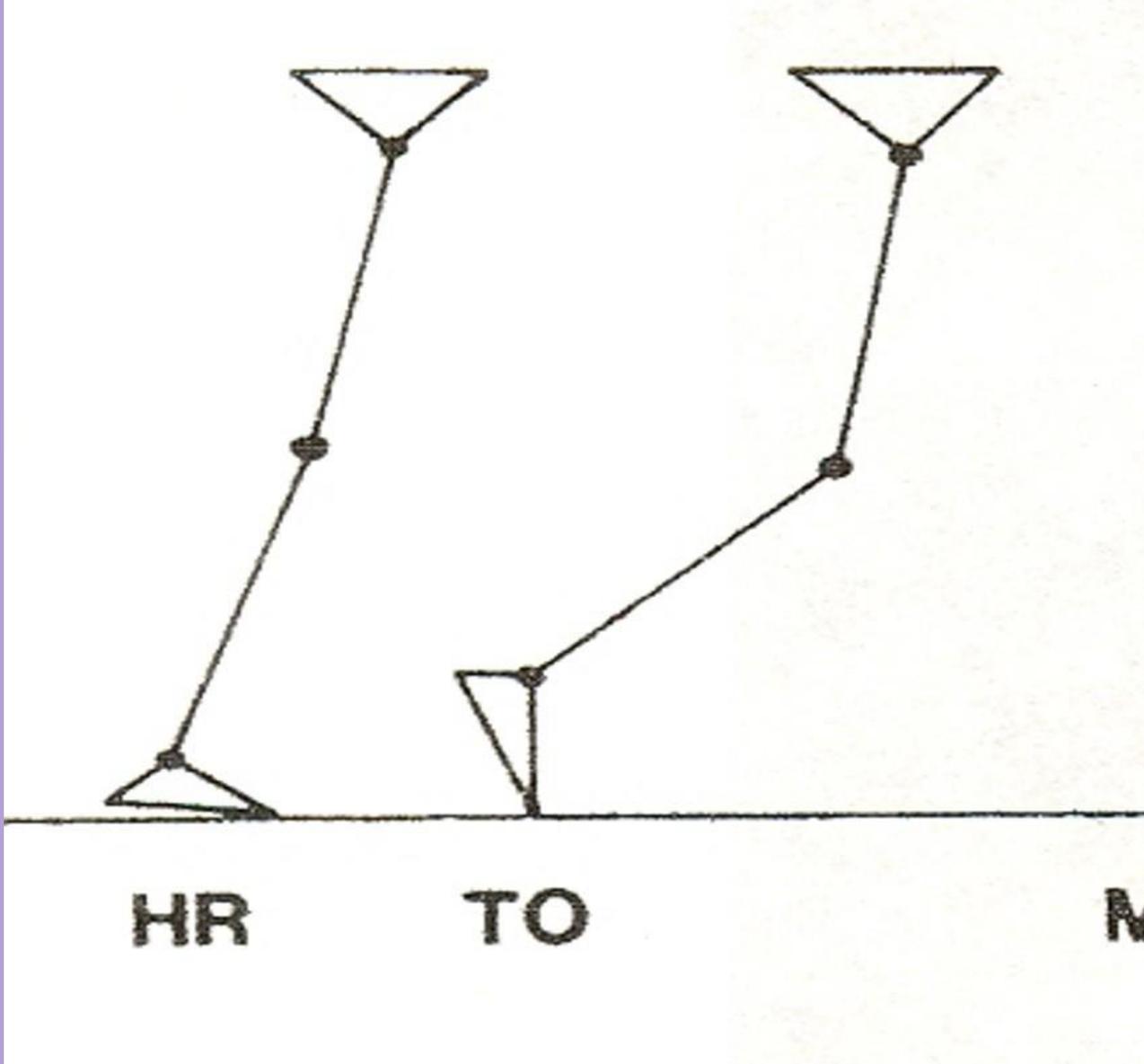
Medial foot includes *talonavicular, cuneonavicular joints and 1st, 2nd and 3rd rays*

OCCURS BETWEEN HEEL LIFT AND TOE-OFF

Forms a *rigid foot lever*

Propels the body forward and extends the right limb length, countering a *vertical drop in height of the COG*





Medial Foot Phase



So, there you have it

The lower half biomechanical screen ***never replaces the lower quadrant scanning exam***

Nor the ***detailed, biomechanical assessment*** of an ***obvious, locally traumatized*** area of the body

You are hunting for the **SILENT CULPRIT!!!**



ASPIRE OMT

A Teaching Institute for Orthopedic Manual Therapists

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