Section 34: Hip - Biomechanical Properties

Biomechanics

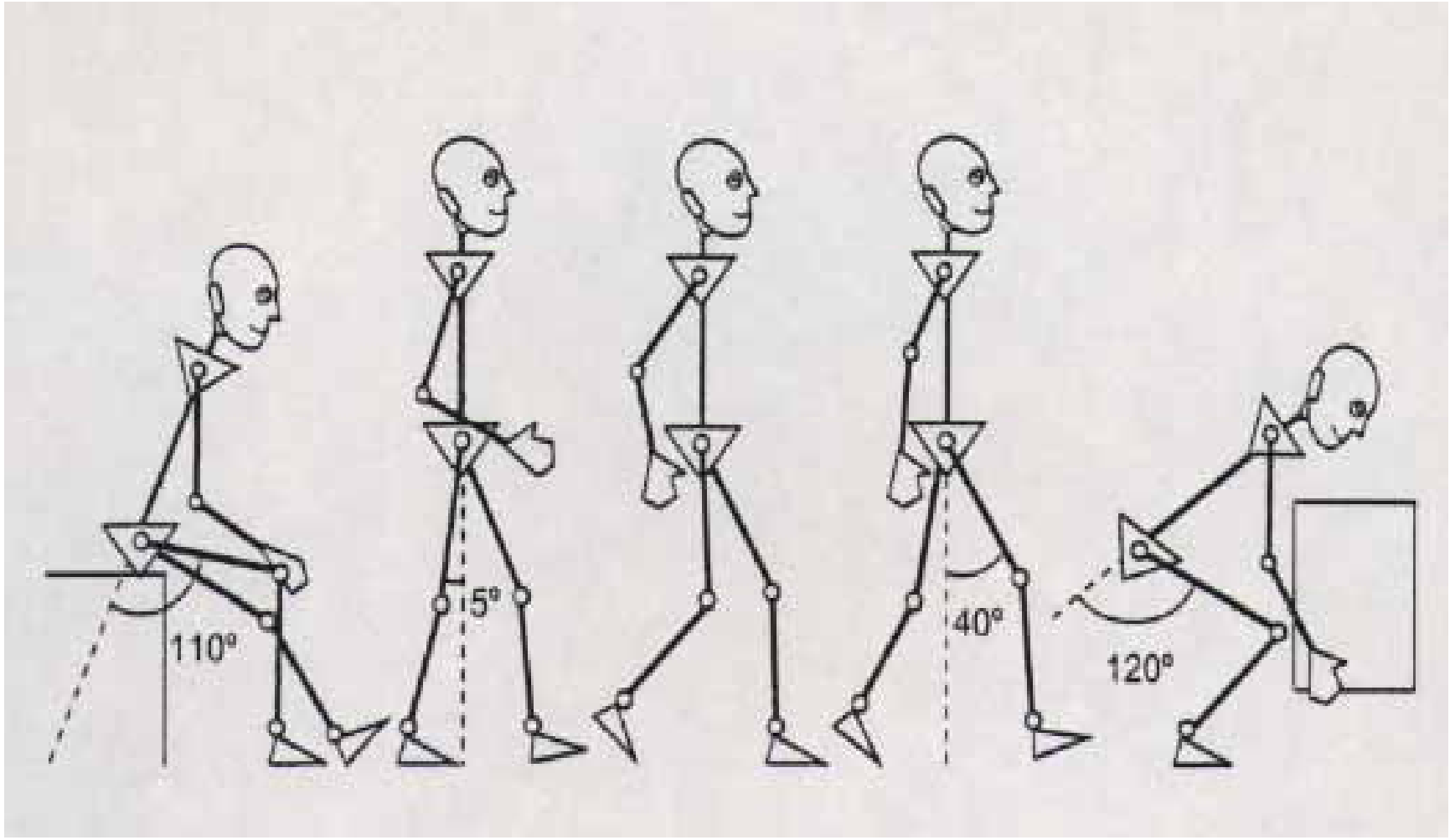
- Dynamic analysis much more complex
- Forces across hip joint combination of:
  - Body weight
  - Ground reaction forces
  - Abductor muscle forces

The hip joint is loaded in the following manner;

- standing - 1/3 of body weight
- standing on one limb - 2-2.5x body weight
- walking - 1.5 - 5.5x body weight
- walking stairs - 3x body weight
- running - 4.5x > body weight depending upon the ability of the runner and the type of running to be performed.

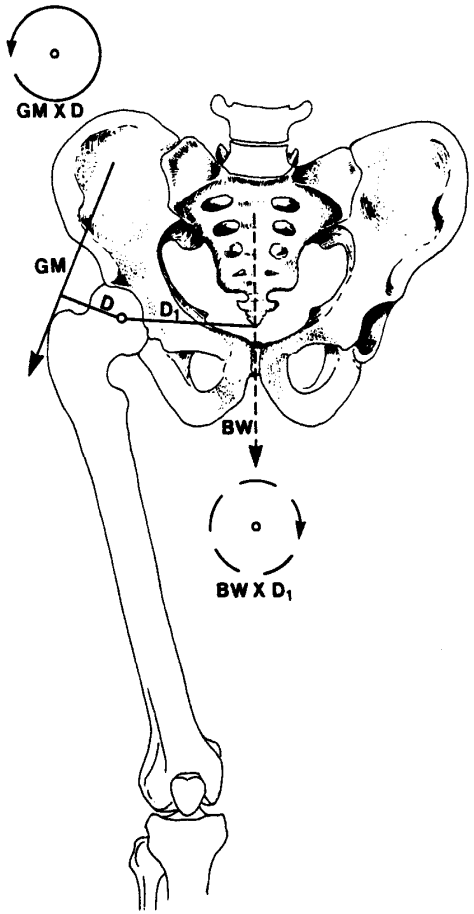
From: Bajekal

HIP ANGLES OF DAILY ACTIVITY



From: Gough

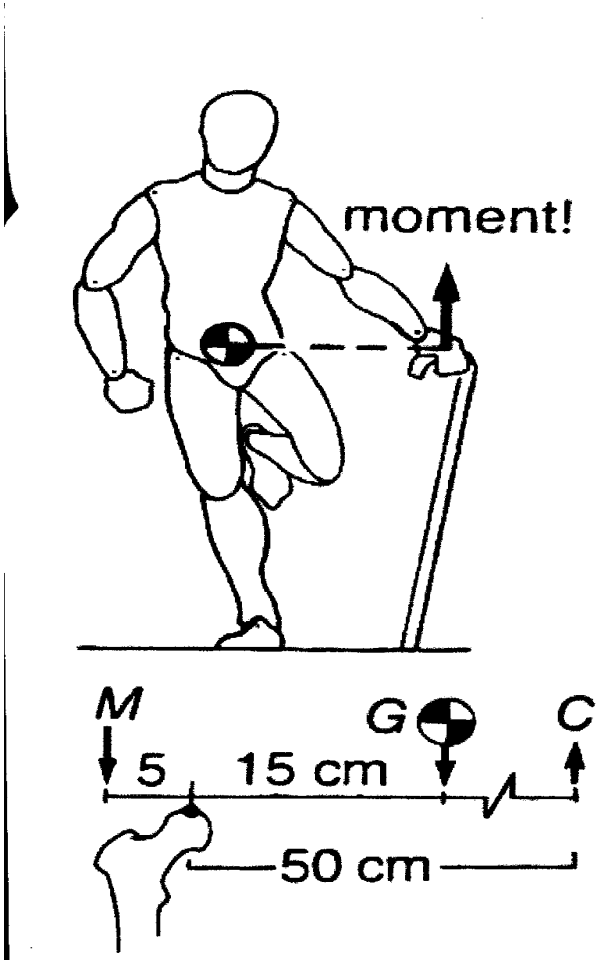
2D Static Analysis



- One legged stance 5/6 BW on femoral head
- Ratio of lever arms to BW 3:1

From: Stone

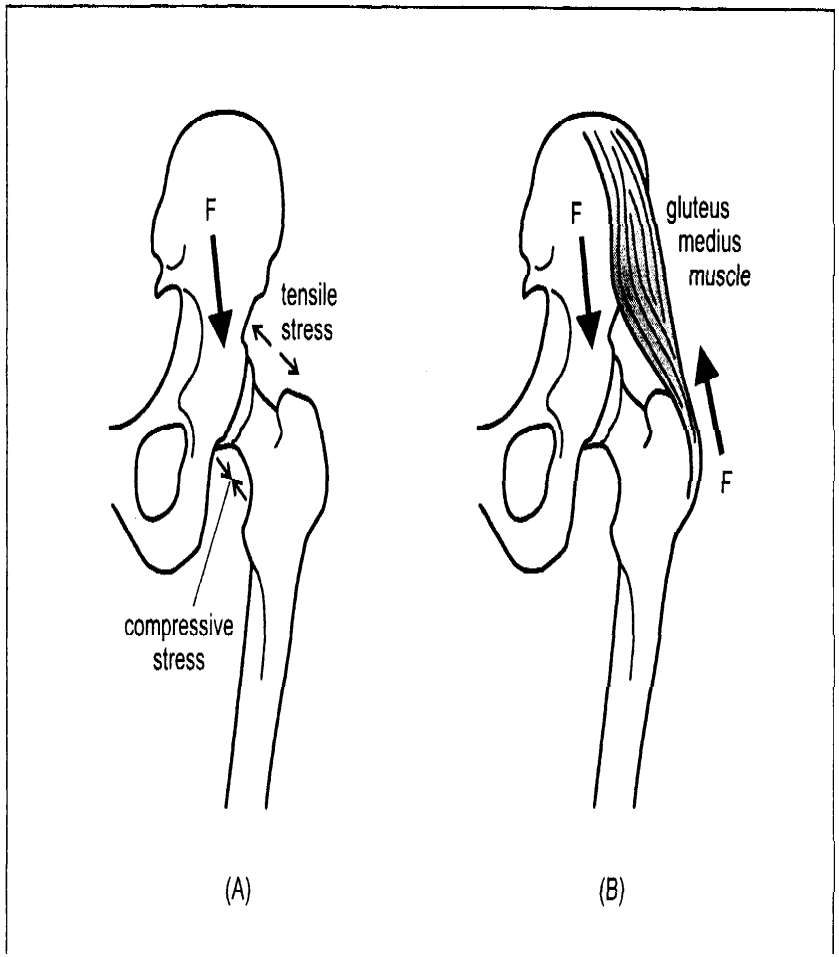
Biomechanics of Cane



- Cane in Contralateral hand decreases JRF
- Long moment arm makes so effective
- 15% BW to cane reduces joint contact forces by 50%

From: Stone

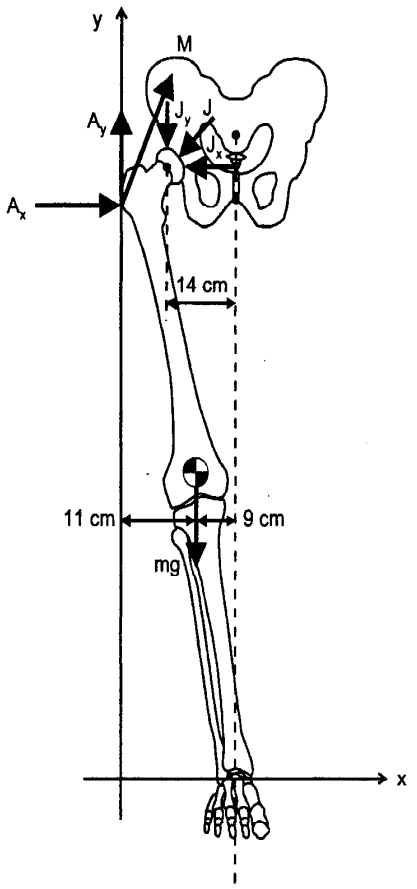
INFLUENCE OF MUSCLE ACTIVITY



- **Muscles will often contract, not to cause movement, but to equalise stress accumulations on bones.**
- **A good example of this is the hip joint and the femur.**

From: Gough

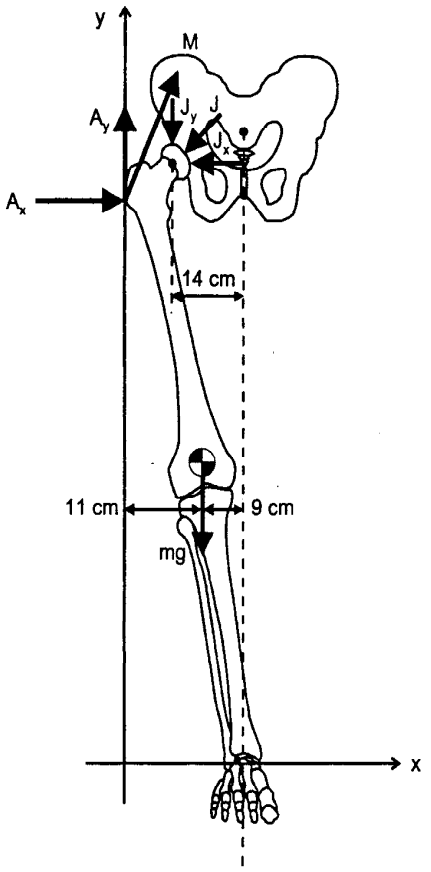
BIOMECHANICS OF MUSCLE INFLUENCE IN THE HIP



- **BONE IS STRONGER IN COMPRESSION**
- **HOWEVER WHERE THERE IS COMPRESSION THERE IS ALSO A TENSILE STRESS**

From: Gough

BIOMECHANICAL ANALYSIS OF MUSCLE FORCE



- Each lower limb makes up around 15% of total body weight.
- Therefore
- A man weighing 800 N
- W_{LL}= 15% 100%=800x0.15 = 120 N

From: Gough

Common Injuries

- Dislocation

-femoral head moves out of the acetabulum

-usually it goes posterior into notch

-position typically flexion, adduction, and internal rotation

-common mechanism: knee to dashboard during traffic collision

-signs and symptoms: extreme pain, obvious deformity, unwilling to move the extremity

From: Howard and Rivera

COMMON INJURIES

- Hip Fracture

-most frequently occurs through the femoral neck

-a direct blow to the lateral hip

-signs and symptoms: pain, swelling, and loss of function

-the involved leg will appear shortened and will be externally rotated

From: Howard and Rivera