The Anatomy of Squats

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Friends don’t let friends skip leg day.
Let’s Talk Human Adaptations

The human pelvis has evolved shorter, broader, and rotates inward to best support our body upright and our internal organs. The human femur has become longer and slender with a wider angle at the head.
Evolution of Human Bipedalism

So hungry. Must forage for food!
What affects the way you squat?

**Parallel squat, Powerlifting squat**
Anatomical parallel when a line between the knee joint and the hip joint is parallel with the floor. In powerlifting the line is instead drawn between two points on the top of the thigh. Note that irrespective of the definition, the depth shown below is not quite enough!

**Full squat, deep squat, ATG (Ass To Grass)**
This squat has no doubt gone beyond parallel depth. Maximum depth depends on how much the hamstrings can be stretched and on the amount of space between the calves and the posterior surface of the thighs.

**Quarter squat**
To be true to its name, this squat should be the result of a 45° flexion but a larger flexion of about 60° is probably more common.

**Half squat, 90° squat**
Corresponds to a 90° flexion about hip and knee. This will result in a easily identifiable perpendicular angle between the thigh and the lower leg.
Hip Bones
Acetabulum

Pelvis “socket”
Progressively shallower hip socket
Femoral Head
Femoral Head Angle

A Normal

B Coxa vara

C Coxa valga

Angle of inclination

125°

105°

140°
Femoral Head

(A) Normal angle of inclination
(B) Coxa vara (abnormally decreased angle of inclination)
(C) Coxa valga (abnormally increased angle of inclination)
Patellofemoral Joint

- Patella
- Femur
- Posterior cruciate ligament
- Anterior cruciate ligament
- Meniscus
- Meniscal ligament
- Tibia
- Patella
- Prepatellar bursa

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Torque

Force determined by angle of the spine

The hip is the moment arm

\[ t = F \times d \]
Torque

\[ T = F \times d \times \cos \theta \]
Biomechanics
Height as a Limiting Factor for Squatting
Osteoporosis (decreased bone density)
Squatting is an Intentional Adaptive Stress

This means it can help increase bone density and strengthen the connective tissues and muscles supporting the joint by:

1. Increasing **force** (squats tug on muscles attached to bone)
2. Add **impact** (stepping down from a lunge);
3. **Changing the direction** of your squat (forward, diagonal, and side lunges) tugs on the bone from different directions
The End.

QUESTIONS?