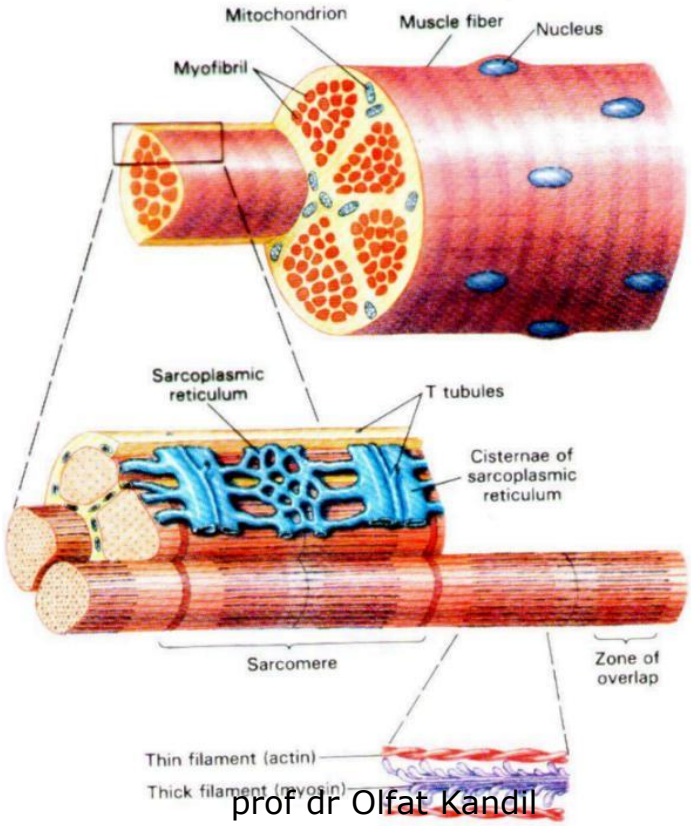
Internal Moment



Internal torque

- It is the torque produced by forces associated with internal structures (e.g. forces exerted by muscles or transmitted through tendons and other soft tissues) times their moment arm.

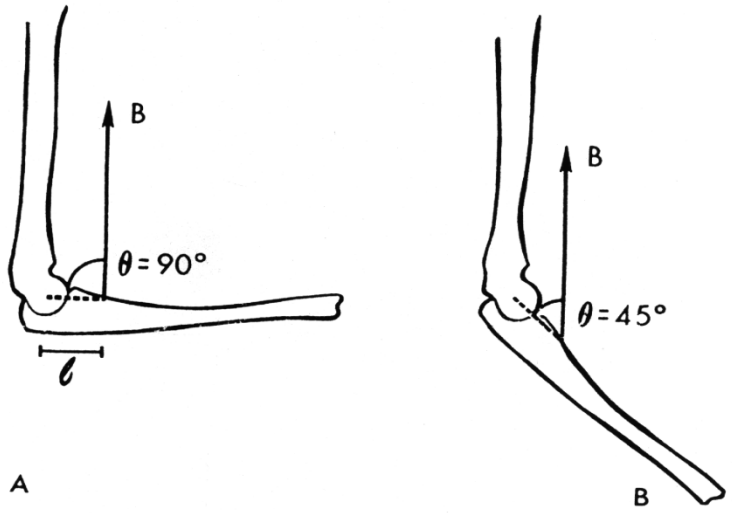
Factors affecting internal torque

Factors related to force

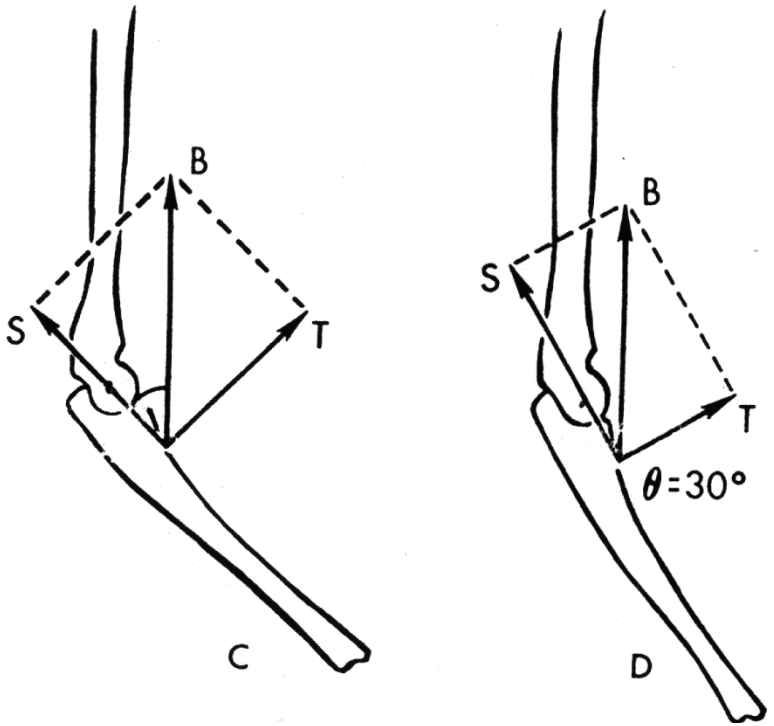
1) Physiologic cross-section.

2) The angle of pull or attachment p 93:

between the line of action of the force and the underling surface or segment.



- Factors related to force



The change in angle of pull through the range of elbow movement

- Factors related to force

3) Type of muscle contraction:

Eccentric contraction of the muscle develops greatest torque among the three types of muscle contraction.

- Factors related to force

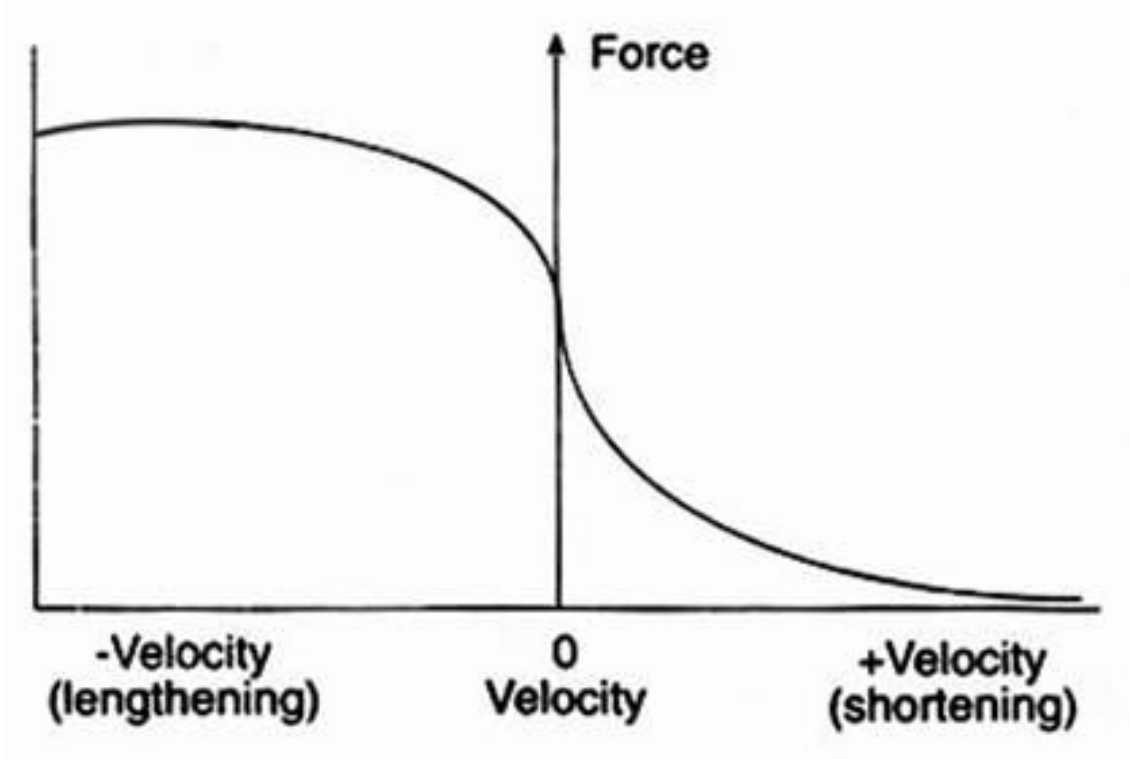
4) Velocity:

During isometric contraction "zero velocity" great tension is developed. If velocity of shortening increases, force decreases.

- Factors related to force

Force Velocity Relationship

P59



- Factors related to force

5) Length- tension relationship.

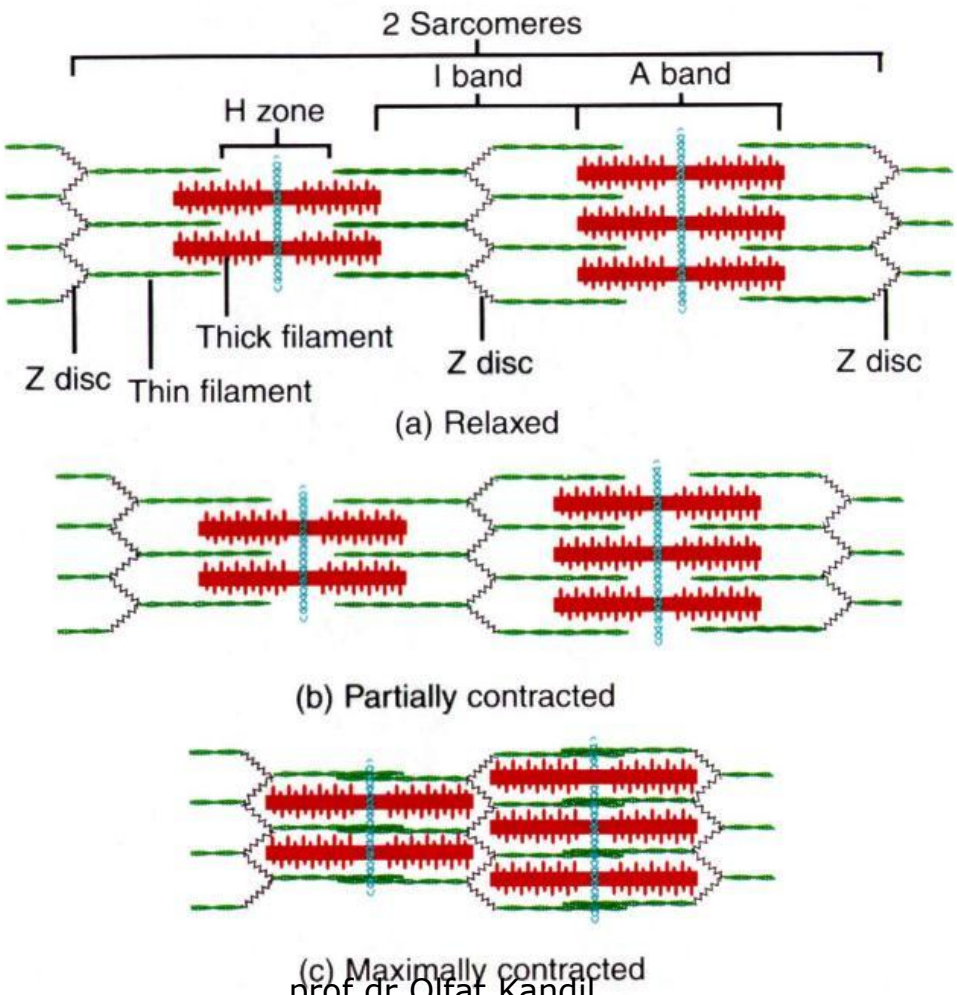
Tension: it refers to the magnitude of the pull of the muscle.

Passive tension: It is developed when an unstimulated muscle is elongated by any outside force from its resting length.

Total tension:

It is the sum of passive tension and developed tension by contractile element when the muscle is stimulated.

- Factors related to force



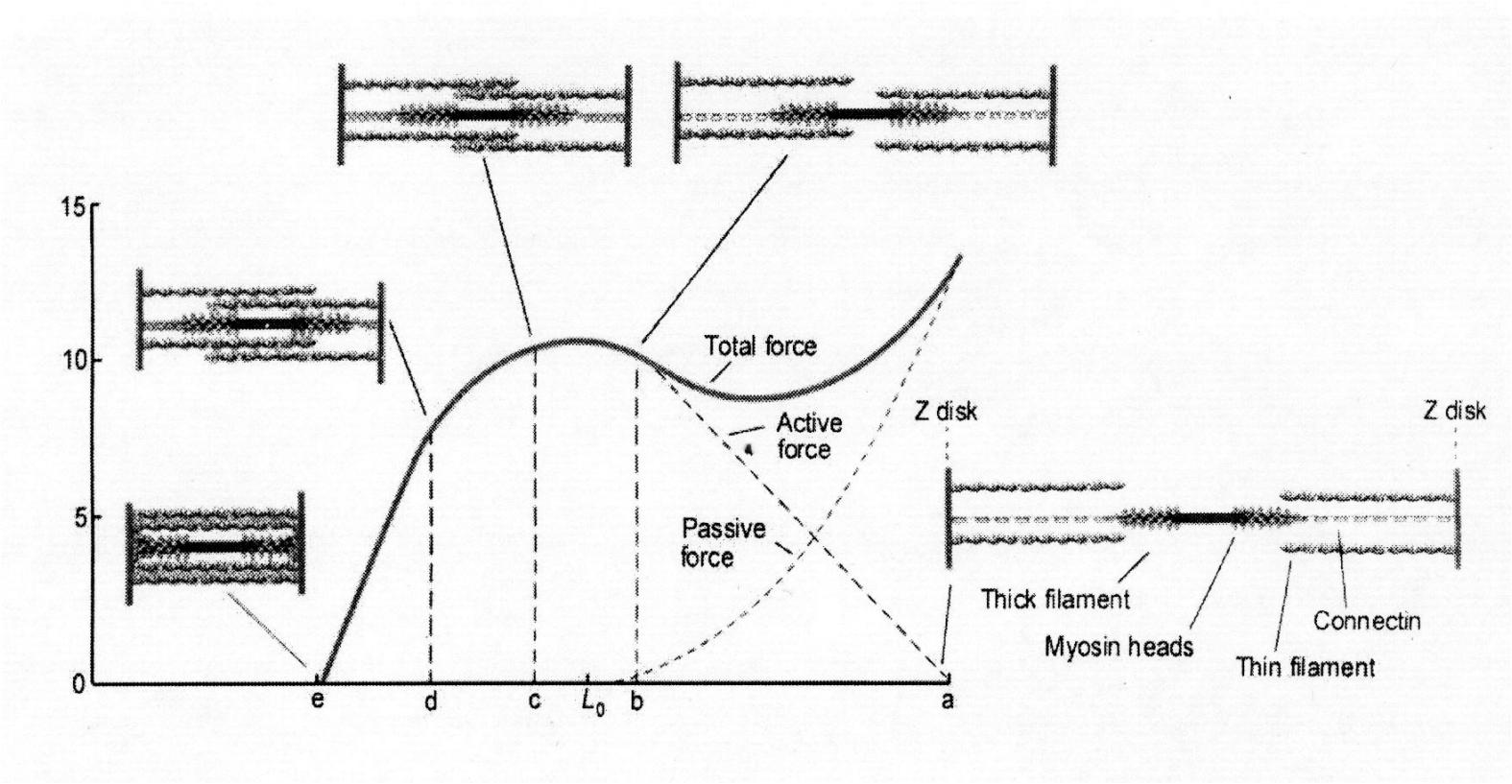
Contractile element

of a muscle

- Factors related to force

- **Length –tension relationship** means the variation in the force output of a muscle with the same neural input over a range of lengths.

- Factors related to force



Typical Length tension curve for intact human muscle p 57

- Factors related to force

- **Resting length:**

Is the length of unstimulated muscle or muscle or muscle fibers and no external forces are acting on it.

- **Initial length:**

The length of the muscle at the time of stimulation influences the magnitude of its contractile response to a given stimulus.

- ***The greatest length that the muscle can attain in the normal living body is about 1.2 times the muscle's resting length. Tension capability is less at shorter and longer length.***

- Factors related to force

6) Other factors:

- Force-time relationship.
- Effect of prestretching.
- Effect of temperature.
- Muscle fiber differentiation.

- Factors related to force

7) General factors: Related to age, sex, athletic training , Where the increase in moment production(strength) is linked with the male middle age athletic person

Self learning : think of factors you may find it more effective on moment exertion

How to apply in clinical situations (use text)

STATIC EQUILIBRIUM CONDITIONS

- First condition of Equilibrium (Translatory equilibrium or force equilibrium)

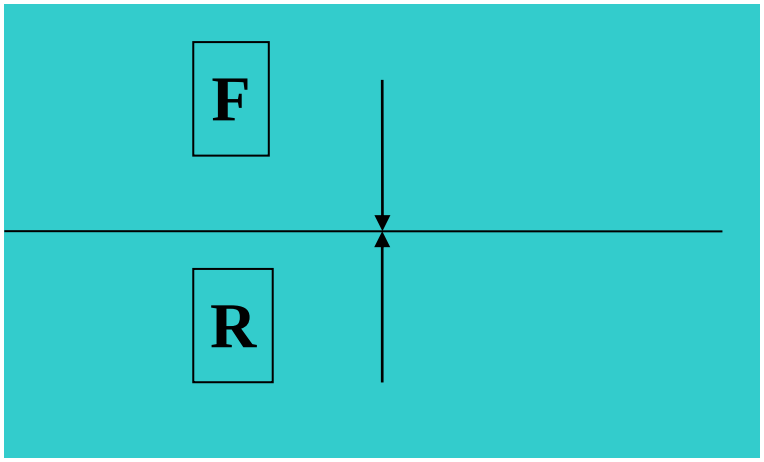
- In this condition of static equilibrium all forces those are acting on a body simultaneously have their combined effect cancelled and their resultant is zero and the body will not be displaced (zero velocity).

$$\Sigma F = 0$$

- First condition of Equilibrium (Translatory equilibrium or force equilibrium)

- **Application to different force systems:**

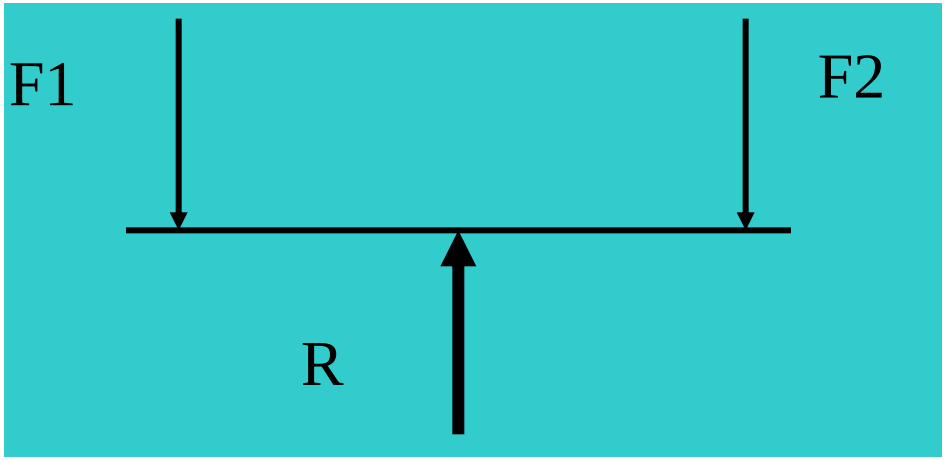
***a-Linear force system*:** In this system, if two forces acting on a body to be in equilibrium, the forces must be equal in magnitude and opposite in direction



- First condition of Equilibrium (Translatory equilibrium or force equilibrium)

- **Application to different force systems:**

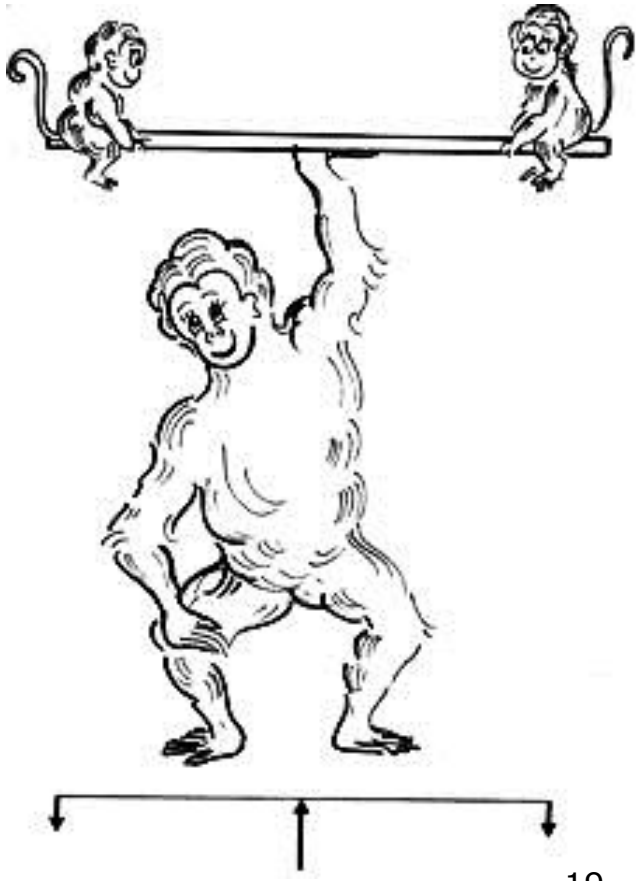
b-Parallel force system: In this system for force equilibrium, all upward directed forces minus downward directed forces must equal zero. In other wards forces directed downwards are equal to the forces directed upwards.



- First condition of Equilibrium (Translatory equilibrium or force equilibrium)

- **Application to different force systems:**

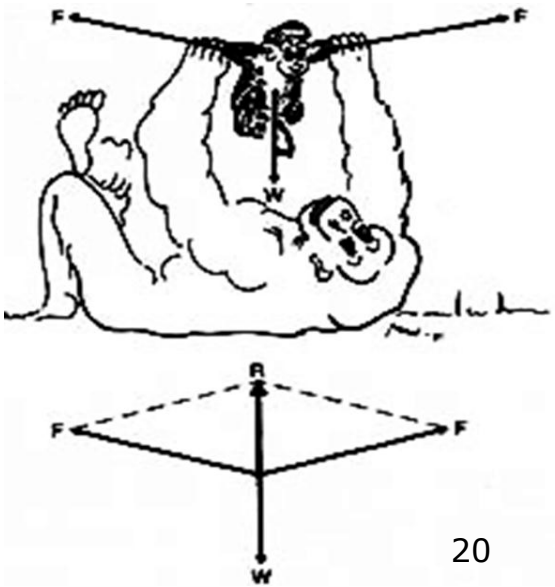
b-Parallel force system



- First condition of Equilibrium (Translatory equilibrium or force equilibrium)

- **Application to different force systems:**

c- concurrent force system: Two coplanner, nonparallel forces are acting on a rigid body, a third force must act to maintain equilibrium. The third force is its equilibrant (the equilibrant equal the resultant in magnitude but opposite in direction.(3rd Newton law).



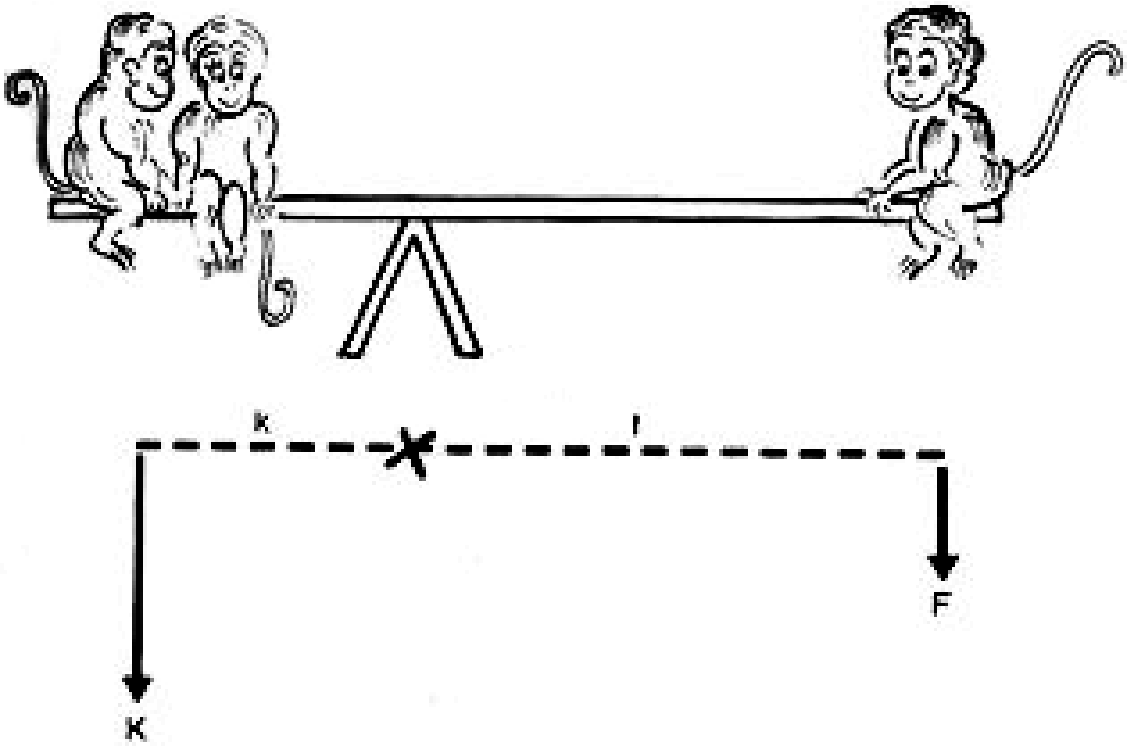
- Second condition of equilibrium (Rotatory equilibrium or moment equilibrium).

- This condition of static equilibrium is achieved when the sum of moments tending to rotate the body in one direction (clockwise (cw) minus the sum of the moments tending to rotate the body in the opposite direction (counter clockwise (ccw) equal zero.

$$\Sigma M = 0 \text{ or}$$
$$\Sigma M_{cw} + \Sigma M_{ccw} = 0$$

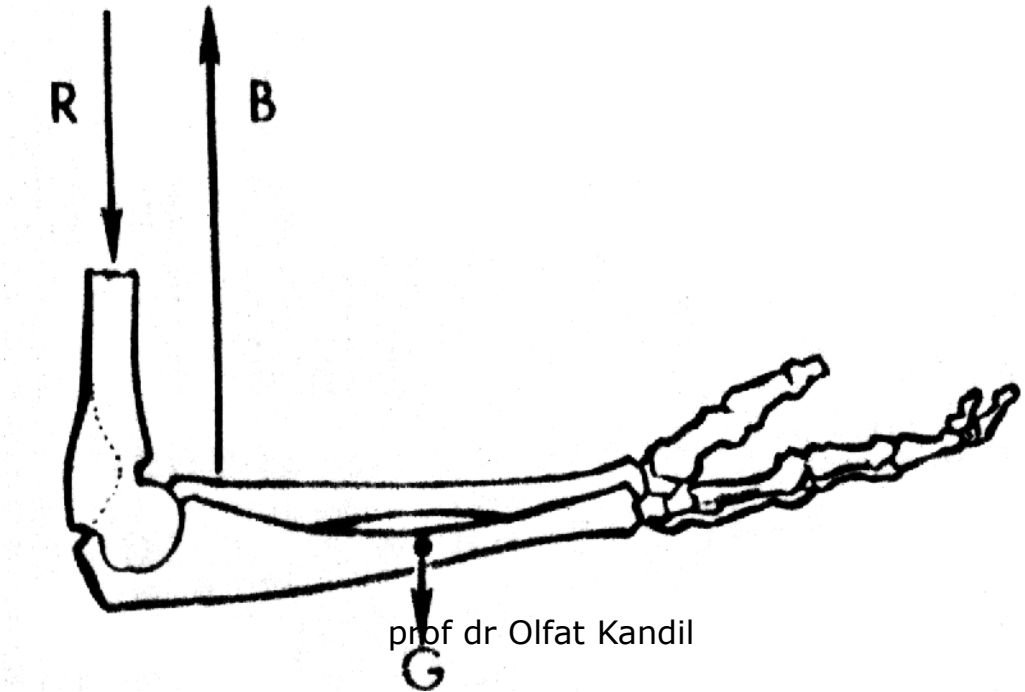
- Second condition of equilibrium (Rotatory equilibrium or moment equilibrium).

- In this condition, no rotation of the body takes place

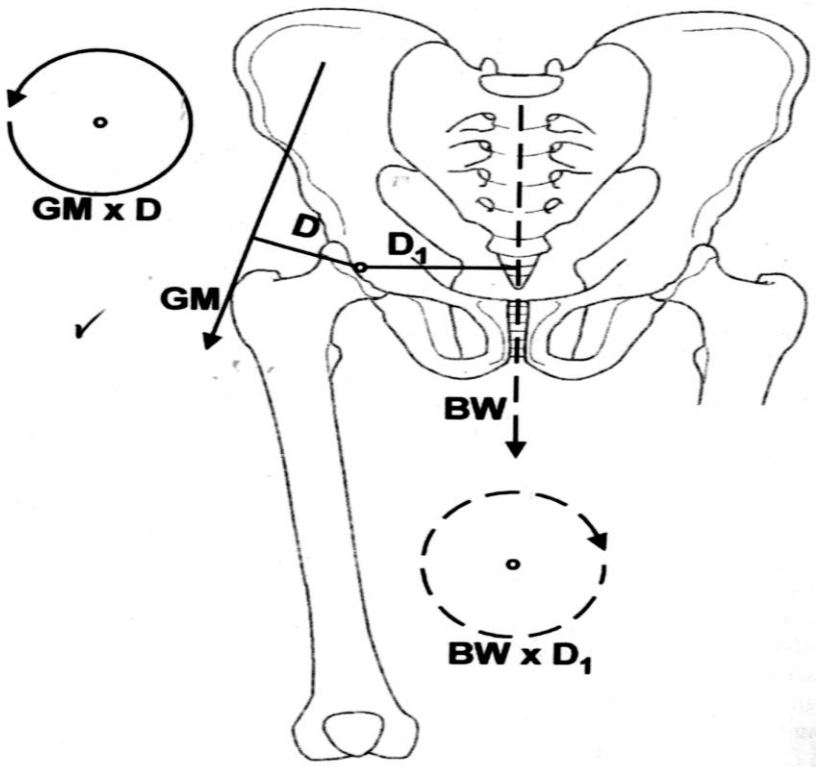


- Second condition of equilibrium (Rotatory equilibrium or moment equilibrium).

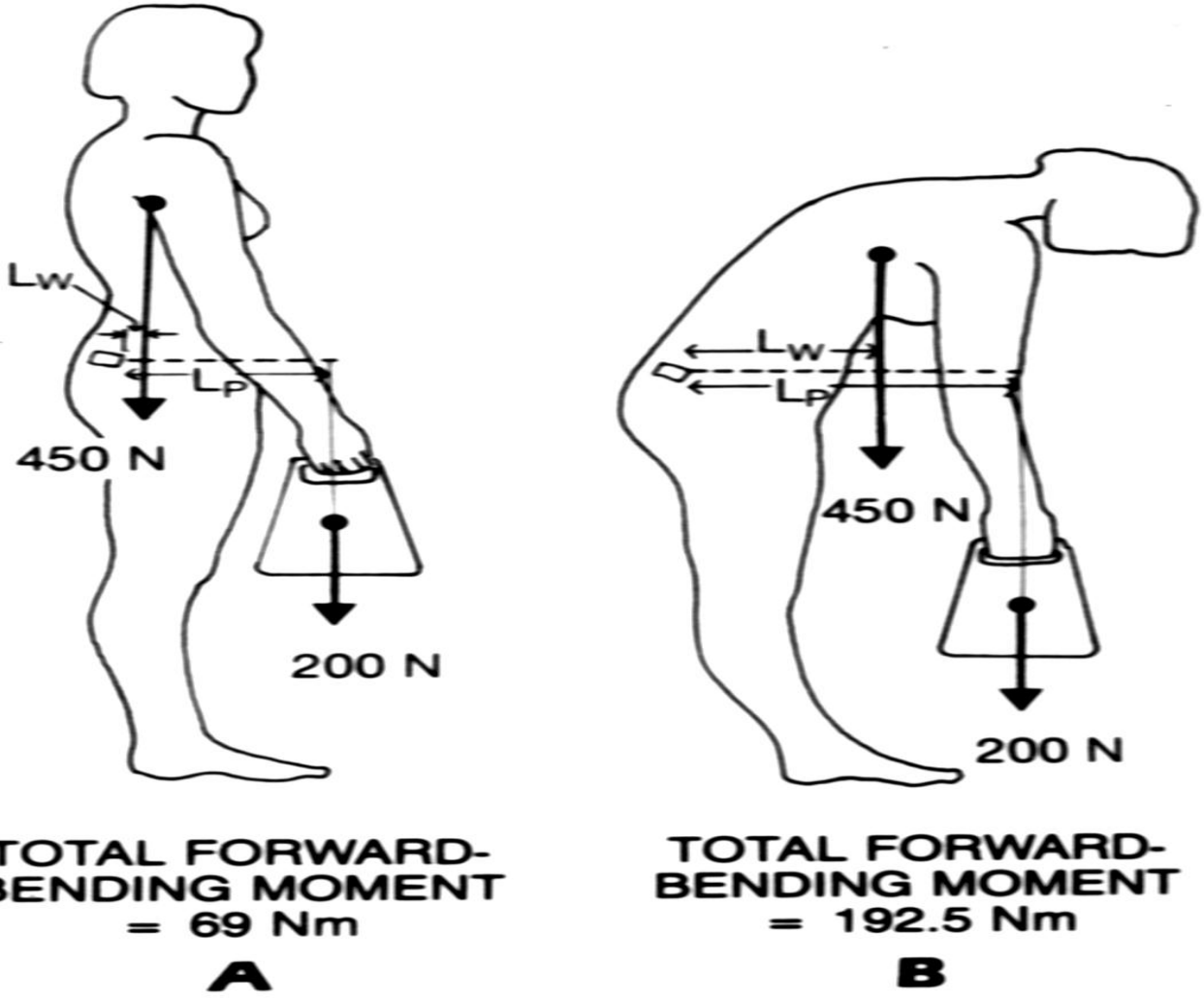
- In the body the moments created around a joint is a typical example for moment equilibrium .is very common in body activities (see text p p 15and 95)



Stability of the hip region



Abductor mechanism pp110 and 497



The same external weight, different total bending moment in A and B

See pp 354 and 410

Compare between stoop and squat lift

- Use the principles of moment in patient education and graduation of exercise (S L)


THANK YOU