Force in human

جامعه المعقل/كليه طب الاسنان
فيزياء طبيه/مرحله اولى
د.صلاح عبد الجبار

static equilibrium

The Earth exerts an attractive force on the mass of an object weight can be considered a force acting through a single point called the center of mass or center of gravity.

a body is in static equilibrium if the vectorial sum of both the forces and the torques acting on the body is zero.

If abody is unsupported, the force of gravity accelerates it, and the body is not in equilibrium. In order that a body be in stable equilibrium, it must be properly supported

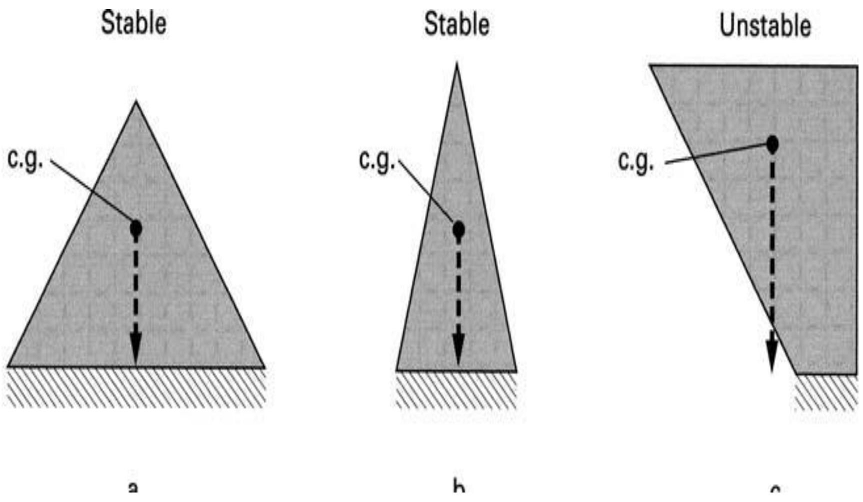
static equilibrium

The position of the center of mass with respect to the base of support determines

whether the body is stable or not. A body is in stable equilibrium under

the action of gravity if its center of mass is directly over its base of support

(Fig. 1.1).



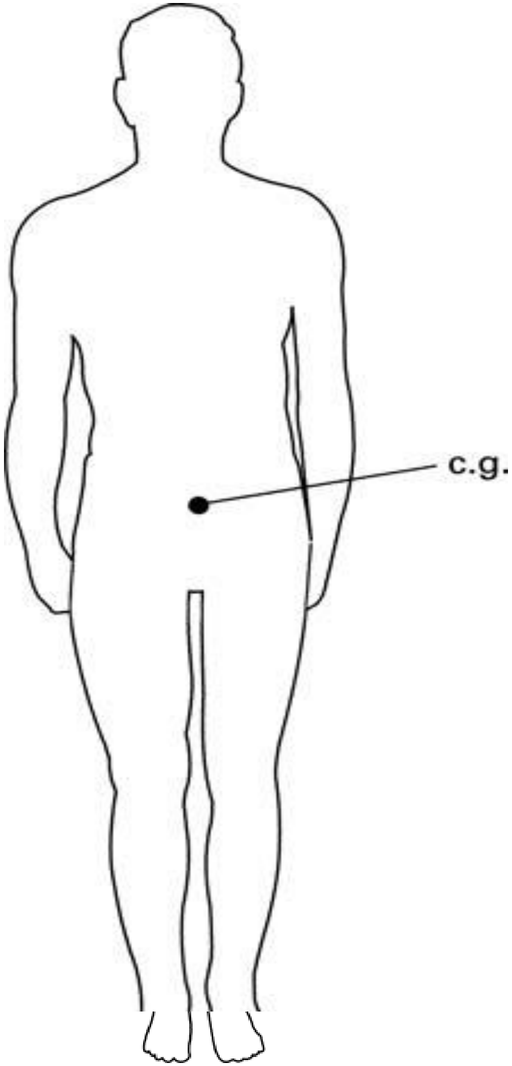
Equilibrium Considerations for the Human Body

The center of gravity (c.g.) of an erect person with arms at the side is at approximately 56% of the person’s height measured from the soles of the feet

(Fig. 1.3). The center of gravity shifts as the person moves and bends. The act of balancing requires maintenance of the center of gravity above the feet.

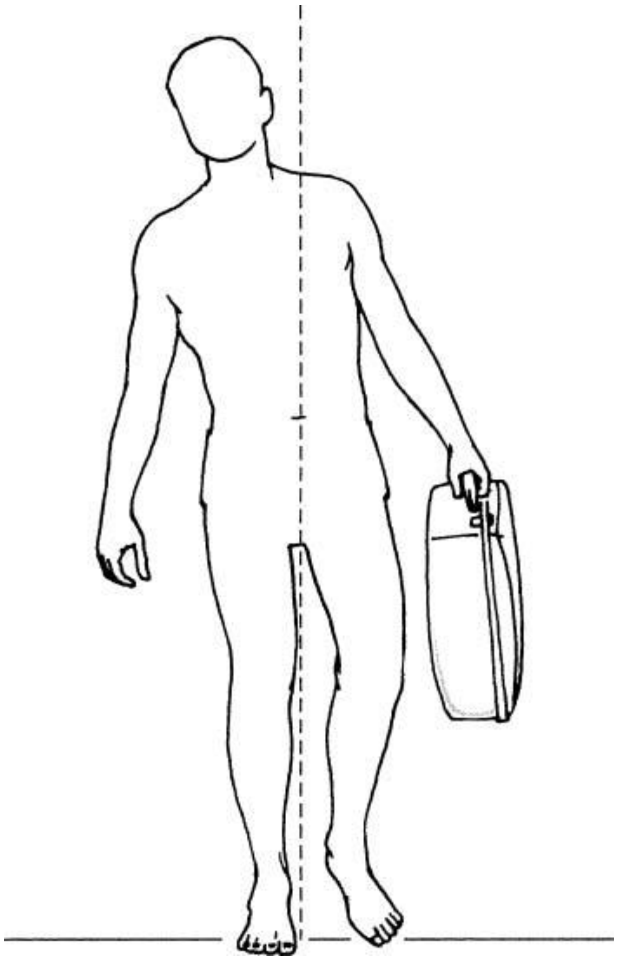
A person falls when his center of gravity is displaced beyond the position of

the feet.



Equilibrium Considerations for the Human Body

When carrying an uneven load, the body tends to compensate by bending and extending the limbs so as to shift the center of gravity back over the feet. For example, when a person carries a weight in one arm, the other arm



Equilibrium Considerations for the Human Body

swings away from the body and the torso bends away from the load (Fig. 1.4).

This tendency of the body to compensate for uneven weight distribution often

causes problems for people who have lost an arm, as the continuous compensatory

bending of the torso can result in a permanent distortion of the spine. It

is often recommended that amputees wear an artificial arm, even if they cannot

use it, to restore balanced weight distribution.

Skeletal Muscles

The skeletal muscles producing skeletal movements consist of many thousands of parallel fibers wrapped in a flexible sheath that narrows at both ends into tendons (Fig. 1.8). The tendons, which are made of strong tissue, grow into the bone and attach the muscle to the bone. Most muscles taper to a single tendon. But some muscles end in two or three tendons; these muscles are called, respectively, biceps and triceps. Each end of the muscle is attached to a different bone. In general, the two bones attached by muscles are free tomove with respect to each other at the joints where they contact each other.

The muscles always begin and end in the bones that touch one another, and they never begin and end on the same bone. . . .

Equilibrium Considerations for the Human Body

"function of the muscles to pull and not to push except in the cases of the genital member and the tongue."

There is a great variability in the pulling force that a given muscle can apply.

The force of contraction at any time is determined by the number of individual fibers that are contracting within the muscle. When an individual fiber receives an electrical stimulus, it tends to contract to its full ability. If a stronger pulling force is required, a larger number of fibers are stimulated to contract. Experiments have shown that the maximum force a muscle is capable of exerting is proportional to its cross section. From measurements, it has been estimated that a muscle can exert a force of about 7×106 dyn/cm2

To compute the forces exerted by muscles, the various joints in the body can be conveniently analyzed in terms of levers. We will assume that the tendons are connected to the bones at well-defined points and that the joints are frictionless.