PROPERTIES OF WATER

www.physiotherapyphd.com

Properties of Water:

The unique properties of water and immersion have profound physiological implications in the delivery of therapeutic exercise.

To utilize aquatics efficiently, practitioners must have a basic understanding of the clinical significance of the static and dynamic properties of water as they affect human immersion and exercise.

The properties;

1. Buoyancy,
2. Hydrostatic pressure,
3. Viscosity,
4. Surface tension

1. Buoyancy

Definition. Buoyancy is the upward force that works opposite to gravity.

Properties. Archimedes' principle states that an immersed body experiences upward thrust equal to the volume of liquid displaced.

Clinical Significance

1. Buoyancy provides the patient with relative weightlessness and joint unloading, allowing performance of active motion with increased ease.
2. Buoyancy allows the practitioner three-dimensional access to the patient.

2. Hydrostatic Pressure

Definition. Hydrostatic pressure is the pressure exerted on immersed objects.

Properties

Pascal's law states that the pressure exerted by fluid on an immersed object is equal on all surfaces of the object.

As the density of water and depth of immersion increase, so does hydrostatic pressure.

Clinical Significance

1. Increased pressure reduces or limits effusion, assists venous return, induces bradycardia, and centralizes peripheral blood flow.

2. The proportionality of depth and pressure allows patients to perform exercise more easily when closer to the surface.

3. Viscosity

Definition. Viscosity is friction occurring between molecules of liquid resulting in resistance to flow.

Properties. Resistance from viscosity is proportional to the velocity of movement through liquid.

Clinical Significance

1. Water's viscosity creates resistance with all active movements.
2. A shorter lever arm results in increased resistance. During manual resistance exercises stabilizing an extremity proximally require the patient to perform more work.
3. Stabilizing an extremity distally requires the patient to perform less work.
4. Increasing the surface area moving through water increases resistance.

4. Surface Tension

Definition. The surface of a fluid acts as a membrane under tension. Surface tension is measured as force per unit length.

Properties

The attraction of surface molecules is parallel to the surface.

The resistive force of surface tension changes proportionally to the size of the object moving through the fluid surface.

Clinical Significance

1. An extremity that moves through the surface performs more work than if kept under water.
2. Using equipment at the surface of the water increases the resistance.