
PresShear Vector™ Summary

To understand the relationship between the various causative factors associated with pressure ulcer prevention and treatment, one must address the basic principles of physics, chemistry and mechanics. The weight of the body is the load that must be supported by the support surface stress (Newton's 3rd Law). The human body responds to the support surface in a stress to strain relationship.

In short, the support surface delivers mechanical stress (force/area) to the soft tissue, which responds to this stress in a strain fashion (change in dimension/original dimension). The three types of mechanical stress are pressure, tension and shear. These various mechanical stresses are created when force is delivered in a specific direction over an area of contact between the body and the support surface. Pressure is the mechanical stress created when the force is delivered at right angles (perpendicular or normal) to the surface of interest (body). When the pressure is delivered in a non-gradient fashion (equalized) it will create volumetric compression of the soft tissue (cradling), while if it is delivered in a gradient fashion (unequalized) then tensile stress (shortening or elongation) occurs. This gradient or unequal pressure creates soft tissue distortion, which has been defined as vertical shear, or vertical distortion.

When the force is delivered in a parallel (tangential) direction to the surface of interest (body), then the mechanical stress that is created is shear. This mechanical stress of shear causes shear strain (soft tissue distortion). Here we see the confusion when dealing with the term "shear". Shear is the term that relates to the mechanical stress delivered by the support surface and also the soft tissue strain (distortion) caused by the shear stress. One must remember tangential force over area, or shear stress, causes soft tissue distortion, or shear strain. This is why one must always identify which shear is being considered. In summary, when one refers to shear stress, one is defining the direction at which the force is being delivered by the surface to the body; while when one refers to shear strain one is referring to soft tissue shape change or distortion.

Another confusing issue is trying to incorporate friction into the PresShear Vector™ equation. Friction is defined as the tendency of two bodies (support surface material and body's skin) to stick together due to the nature of the two contacting surfaces. Frictional force is delivered tangential to the contact surface of interest (body). This stress then causes shear strain (soft tissue distortion).

The complex PresShear Vector™ created by the various directions and gradiencies of forces being delivered to the human body's soft tissue by the support surface product can deliver either the desired non-gradient pressure stress (flotation) or shear stress which creates shear strain (distortion).

The container design, but most importantly, the type of media (gas, liquid, sol, gel, or solid) dictates which mechanical stress is delivered by the support surface to the soft tissue at risk. Being aware of the difference in the physical properties between solids (gel, foam, wood, cloth, etc.) and static fluids (gas, liquid, sol) is very important. The main differences are solids can sustain internal shearing forces, while fluids cannot. This property of solids explains why solids can deliver shear stress to the body and static fluids cannot. The use of static air over other types of fluids is desired due to the pressure gradiency within the other more dense and viscous fluids (liquid, sol). Thus, the use of static air as the media in a pliable contouring single chamber container most closely mimics pure flotation therapy.

This concept is well documented in the basic laws of physics and chemistry. The Kinetic Molecular Theory, Ideal Gas Law, Buoyancy Principle and Pascal Principle are the defining rules relating to static fluid flotation therapy. Dynamic fluids have different mechanical properties that separate them from static fluids. The beneficial physical properties of static fluid mechanics cannot be superimposed on dynamics fluid systems.
