Properties of Skin

www.physiotherapyphd.com

The Properties of the skins are nonlinearity, viscoelasticity, anisotropy, loading history dependency, failure properties, and aging effects.

Nonlinearity There are differences in the skin of the same individual depending on location on the body, and there are differences between individuals. There are also directional effects of skin, which are explained by Langer's cleavage lines. The stress-strain relationships in uniaxial tension show skin to be stiffer along Langer's lines than across the lines. As a result, skin incisions perpendicular to Langer's lines gap more than those parallel to the lines.

Skin anisotropicity was recognized by Langer, who mapped the natural lines of tension that occur within the skin. These lines are known as the Langer lines. A tensile test showed that the mechanical deformation of skin is dependent upon the specimen's orientation along Langer lines.

The **Viscoelasticity** of skin is dependent on strain level, rate, and temperature. A strain-level dependence of relaxation functions is found skin. Anisotropy also plays an interesting role in the viscoelastic properties of skin.

Loading History Dependency The traditional mechanical characteristics of homogeneous materials are not characteristically found for skin. Skin has no unique, single Young's modulus, nor shear modulus. These properties for skin are not material constants, but vary depending on the strain applied. As for viscoelastic behavior, previous studies on skin tissue reveal that its stress-strain relationship depends on strain rate, loading rate, the period of loading and on the preconditioning stress history it has also been established that skin tissue exhibits considerable hysteresis in cyclic tests, as well as stress relaxation under constant strain.

Thermal Loading with the increase of skin temperature, the heat-labile intramolecular crosslinks in collagen are gradually broken, and the collagen undergoes a transition from a highly organized crystalline structure to a random, gel-like state. This process is termed ‘thermal denaturation’, which appears accordingly as thermal shrinkage. Skin also contains a small mount of elastin (0.1% of skin dry weight), which is thermally very stable, and capable of surviving in boiling water for hours with no apparent change.