



TISSUE BIOMECHANICS

WHAT ARE TISSUE BIOMECHANICS?

Biomechanics is “the mechanics of biological and especially muscular activity” (Merriam-Webster).

Two of the articles in this issue of *DIRECTIONS* focus on sleep positioning (also called Postural Management). In Postural Management, biomechanics is used to understand the effects of gravity on posture and positioning, specifically the impact of prolonged static positions on soft tissue.

TYPICAL TISSUE BIOMECHANICS

The human body “remodels” itself on a regular basis, replacing mature tissue with new tissue. Infants remodel 100 percent of their body in a year while adults only remodel about 10 percent. High stresses/forces occurring in an area of the body increases the rate of remodeling.

ATYPICAL TISSUE BIOMECHANICS

Many people with disabilities develop contractures and asymmetries. This occurs primarily due to the inability to move effectively, stabilize posture and change position (Pope, 2007). As the client remains in asymmetrical positions, the tissues adapt to this posture and musculoskeletal distortions result. When the body is not aligned in midline, gravity pulls the body farther away from that midline position, exaggerating the asymmetrical posture. Contractures (a lack of joint mobility) occur due to structural changes of the tissues.

PHYSIOLOGY OF TISSUE ADAPTATION – PROLONGED STRETCH

Soft tissue demonstrates plasticity and viscoelastic behaviors. If a part of the body is fully stretched during the night, for example, the tissues are stretched until these cannot elongate further. At this point, micro ruptures occur and the tissues will not return to their original length. Tissue remodeling repairs this damage with collagen fibers, resulting in the area becoming permanently elongated. Tissue on the opposite side of the elongated tissue will become shortened and, as the body continues to remodel itself while these tissues remain shortened, contractures develop (Agustsson & Jonsdottir, 2017).

When a stretch occurs, for example in the hip as a leg falls to one side in supine, any slack in the arthrogenic (bone, capsule, ligament and synovium) and myogenic (muscle and tendon) structures is taken up. As a result, any further available movement will occur as gravity continues to pull on the stretched tissue. In this example, the hip may now begin to rotate.

PHYSIOLOGY OF TISSUE ADAPTATION – IMMOBILITY

When the body remains for an extended time in an asymmetrical posture, this remodeling becomes destructive. Rodby-Bousquet, et al. (2013) found

that adults with cerebral palsy spent between 22 and 24 hours a day in asymmetric positions, both in lying and sitting. The authors also found that up to 50 percent of adults who are unable to independently change their position in bed remain in one position throughout the night where a destructive posture could be maintained for up to 10 hours, leading to tissue changes. Typically, a muscle must remain in a stretched (not on full stretch) position more than six hours a day to maintain length (Tardieu, 1988). Normal range of motion in joints is maintained by repeated movements of the body part each day, as well.

CONCLUSION

Maintaining symmetrical postures, providing sustained stretch of muscles, and providing adequate joint movement are all critical in preventing tissue adaptation resulting in loss of range and orthopedic asymmetries.

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