Mechanical Stress transfer – the fundamental physical basis of all manual therapy techniques

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BACKGROUND:Fundamentally, all manual therapy techniques have in common the same goal. They offer certain means of mechanical stress transfer to a targeted tissue(stress = force per unit area). The result, commonly mistaken for the purpose, may be observed as improved relaxation, function, strength, and pain relief. These beneficial derivatives of manual therapy are made possible from the body's ability to respond to its environments. More specifically, mechanotransduction, the process by which a mechanical input (a stress pattern provided by a given modality of manual therapy) is converted into a biochemical response, eventually being translated into immediate and long term remodeling of tissues - otherwise known as manual therapy outcomes. To date, there exist no studies that examine the ability of different manual therapy techniques/tools to effectively transfer stress to targeted tissues. Thus, the purpose of this study was to utilize engineering principles in order to interpret the effectiveness of manual therapy techniques.

METHODS: A section of human tissue was modeled using finite element methods which included the epidermis, dermis, superficial fascia, and muscle. The extremities of the modeled tissue's cross section were fixed while a compressive force of 5 to 50 Newtons was applied over the epidermis thus mimicking a manual therapy application. The force was applied via various stress transfer mediums (STM), a.k.a. bodyworking tools, exhibiting variable mechanical properties. The explored STMs included steel, bone/elbow, rubber, and strong and weak foams with a modulus of 210 GPa, 15 GPa, 100 MPa, 1 MPa, and 0.5 MPa respectively. Stress was measured in all layer regions of the tissue and compared as a function of the STM. Additional sensitivity analyses followed which evaluated the influence of the selected boundary conditions.

RESULTS: Following loading of the tissue, stress levels in the STM, epidermis, dermis, and superficial fascia layers increased as the STM became less rigid. More specifically, stress in the connective tissue region increased by 12% using a weak foam STM and increased by 6% using a strong foam STM when using a baseline stress attained from using a steel STM. Such variationswere not observed when utilizing bone, wood or rubber STMs. Similar trends, of increased stress transfer when utilizing a softer STM, were observed to take place in the epidermis and dermis. Stress measurements in the deep muscle appeared to undergo no significant modifications.

CONCLUSION:This study suggests, under the conditions described, that using a weaker STM during manual therapy techniques may improve stress transfer. It is therefore advisable to adopt a STM that will facilitate and optimized stress transfer to the targeted tissues.