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Lower Limb Arthroplasty
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Trauma.

Pelvic and Acetabular Fracture Surgery.

Cyclo-ssage Pro-Personal Therapy System. [PPTS]
In the prevention and treatment of activity induced Back Pain.
By Dr. P. Heaton-Ph.D.
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Part 1.

This article reviews the mechanical consequences of exercises and activities of daily living on the vertebral spine with extracts of on going clinical research work with the pro personal therapy system in the prevention and treatment of activity induced back pain.

Anatomy of the back.

The human vertebral column has adaptations for bipedal posture and gait. The column is composed of twenty-four free and nine fused vertebrae. The free vertebrae consist of seven cervical, twelve thoracic and five lumbar elements. The fused vertebrae consist of five sacral and four coccygeal elements.
Interspaced between each free vertebra is an intervertebral disc. Discs are also present between the free vertebra and sequential fused vertebrae. In total there are at least 24 intervertebral discs contributing to as much as twenty five percent of the height of the spinal column. From cervical to lumbar region there is a gradual increase in size of the disc, reflecting the adaptation to load of the elements. A cervical disc typically measures 5mm, a thoracic 7mm, and a lumbar disc averages 10mm in thickness.
Each disc is composed of a centre the nucleus pulpous, surrounded by the annulus fibrosis and bounded to the vertebral end plate.

Spinal location of activity induced back pain.

The lumbar spine is the commonest location in the vertebral spine when patients complain of new onset back pain. Indeed, the intervertebral discs between the fourth and the fifth lumbar (L4/L5) as well as the disc between the fifth lumbar and the first sacral vertebra (L5/S1) are subjected to the highest compressive loads and, are the commonest to prolapse. Furthermore, pain may be referred from one spinal segment to another.

Biomechanical analysis of loading in the intervertebral spine during activities of daily living
The resultant forces in the intervertebral disc and spinal column is significantly higher in the sitting position compared to when standing. Bending and abnormal posturing generates an even higher resultant force on the intervertebral disc and spinal column. These positions generate a resultant force on the intervertebral disc and spine through active and passive muscle and ligament loads. Both passive and active loading of the spine results in significant compression forces. Admittedly, active loading generates a higher resultant force on the intervertebral disc and facet joints than passive loading.
In reaching objects above our head height, the spine attains a degree of obligatory hyperextension with active loading from the erector spinae muscles and passive loading from the core abdominal muscles. Conversely, when rising from the lying position, the spine is actively loaded by the core abdominal muscles with passive loads though the erector spinae muscles. Prolonged active spinal loading would accelerate the compressive-wear effect on the intervertebral disc and spinal column. Fortunately most activities of daily living require a combination of active and passive loading of the spine.

Pathophysiology of activity related back pain.

Displaced disk material causes damage to the spinal nerve roots through a direct compressive effect, neurotoxic effect of the myelin sheath and axonal injury. A vascular effect through diminished radicular blood flow is a significant contributor when prolonged loading is considered.

Pro Personal Therapy System in prevention and treatment of Back Pain.

The cycloid therapy of the Pro Personal Therapy System (PPTS) reduces disc degeneration by enhancing disc metabolism. Delivery of micronutrients and growth factors to the damaged disc nucleus and annulus during the PPTS therapy mode is critical to rehabilitation and prevention of disco genic back pain. PPTS increases training frequency, sports participation and competition rates.
Several studies have demonstrated the altered shape and sequential degeneration of the intervertebral disc with prolonged loading. Current research studies suggest that the shape of the intervertebral disc is crucial to retarding disc degeneration. Disc shape correlates with composition and specifically to proteoglycan concentration. Increased proteoglycan concentration within the disc affords greater polar binding sites for water molecules, the primary component resisting compressive loads in the disc.

The PPTS cycloid pattern of muscle and soft tissue stimulation along the vertebral spine enhances the resolution of the post exercise-activity compression effect on the intervertebral disc. Although the lever arm of the muscles and ligaments remains the same, it is the reduction of the resultant force on the muscles that generates a lower moment of inertia on the vertebral spine and disc. This reduction in the moments of the compressive forces about the intervertebral disc is achieved on completion of one session of treatment lasting 30-45mins. However, sustained treatments of three sessions per week over a six weeks period maximise the potential for the intervertebral disc shape retention. An exciting research project we are currently initiating is aimed at MRI scan disc morphology studies after the above protocol.

Fatigue failure of the annulus manifesting as crack propagation and disc protrusion is the consequence of endurance limit mechanics. Routine use of PPTS in the immediate period following deadlifting and squats exercises has significantly impacted on the onset of activity related back pain. In my practice, athletes are routinely encouraged to incorporate PPTS treatment sessions after every strength and explosive gym workout, with a significant reduction in the incidence of recurrent disc protrusion.

The constituents of the intervertebral discs are not static, but are continually degraded by matrix metalloproteinase (MMP), which are secreted by chondrocytes. With repetitive injury, degradation of the disc matrix occurs. PPTS treatment at this critical interval will encourage newly synthesized matrix by increasing blood flow to the entire spine and injury zone. The delivery through diversion of oxygen rich nutrient blood with matrix stimulating growth factors are proposed mechanisms through which the PPTS effects healing. Other mechanisms are thought to involve free radical removal, marrow stimulation of mesenchymal stem cells differentiation, release of growth factors (FGF, TGF, PDGF, IGF), and enhancement of the arterio-venous microcirculation.

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