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Lower Limb Arthroplasty

(Hip and Knee).

Trauma.

Acetabular Fracture Surgery.

Cyclo-ssage Pro-Personal Therapy System. [PPTS]

In the current treatment of Osteoporosis.

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Pro personal therapy system on biomechanical concepts in Osteoporosis

Osteoporosis is a systemic skeletal disorder that affects the metabolism of mature bone. It is characterised by loss of bone mass. The resulting lower skeletal mass is less resilient to loads of functional activities and is also more prone to fracture from trauma. The load bearing bones of the lower limbs and the vertebral spine are most commonly affected. The triad of decreased bone mass, micro-architectural deterioration and increased bone fragility occur with the aging process. When fractures occur, there is a real risk of recurrent injuries and loss of the individual's Independence, that may dictate Institutionalized care. Several epidemiologic studies have shown the correlation of inactivity and decreased activity with osteoporosis. Overwhelming evidence does exist proving the higher incidence in activity devoid areas (urban environ) as compared with the rural environ. The world health organisation defines osteoporosis as a bone mineral density of 2.5 standard deviations or more below that of a young adult male.

There are two main types of osteoporosis. Type1 osteoporosis is characterised by a post-menopausal trabecular bone loss rates of 2% - 3% per year for 6-10 years. The predominance of trabecular bone involvement predisposes these patients to compression wedge fractures of the vertebral spine. There is a much higher female to male ratio of 6:1. This is an oestrogen deficiency disease state rather than a lack of calcium intake. Because of the relatively higher rates of bone loss, it is also called high turnover osteoporosis.

Type2 osteoporosis occurs in an older cohort of patients. Typically older than 75 years of age, these patients exhibit lower bone loss rates, and hence the alternative description of the cohort as Low turnover osteoporosis. Their disease is predominantly related to calcium deficiency. Trabecular and cortical bones are equally affected as such they are more prone to long bone fractures.

The bone strength of humans peaks at the age 25-30years of age. Beyond this most humans will notice a gradual reduction in bone strength that is hardly noticeable till the middle 40s. The deterioration in bone strength is multifactorial. Hormonal insufficiency, lack of exercise, nutritional deficiencies and genetic predisposition are thought to play a major role. There is very strong evidence that the rate of bone loss is related to the activity level of the individual.

Bone physiology

The primary function of bone is loading bearing for locomotive aid. Bone also serves as a mineral store. Particularly calcium and phosphorus are stored in the medullary canals of the long bones. There are two main types of bones in a healthy adult. Cortical bone is predominantly found in the shaft of long bones. It is stronger than cancellous bone, which is predominant in the spine and ends of long bones. Whilst cortical bone resists torsion and bending stresses, cancellous bone functions to allow elastic deformation of the skeletal system. Both types consist of highly organised tightly packed units of calcium hydroxy phosphate molecules in varying compositions. The composition is of specialised cells in an organic (25%) and an inorganic (70%) matrix. The matrix is composed of collagen molecules (94%) that account for the tensile strength of the bone. A network of non-collagenous proteins (6%) called proteoglycans transfer strain information along the dimensions of bones. In response to loading stress, specialised bone cells (osteoblast) will respond by forming new bone. In order that a delicate balance is maintained at all times, another type of bone cells the osteoclast will remove bone in response to appropriate stimuli.

Bone receives 5-10% of the total output of blood from the pump action of the heart muscle. Known as the cardiac output, it is essential for ensuring that movement within bone and around bone cells is directional

and highly organised. Thus, blood leaving bone and returning to the lungs for oxygenation drains through the venous system in a centre focused direction (centripetal flow). Oxygenated blood delivered by arteries (arterial flow) to bone arrives in a centrifugal pattern. Furthermore, the flow of blood on the outer surface of bones (the periosteal system) is a low pressure system, while the inner surface (the metaphyseal system) is a high pressure flow system. This ensures a clear current is ever present, as stasis is poorly tolerated by such sophisticated systems.

Pro personal therapy system (PPTS)

Utilization of the PPTS mimics increased level of activity irrespective of the level of fitness of the subject. Vibration therapy affords the subject acceptable loading in a controlled environment. Such loading has been demonstrated experimentally both in vivo and in vitro to stimulate bone cell activity. The additional benefit of the vibration loads is the increased flow of blood and delivery of nutrients to the loaded body part during vibration therapy, and with the PPTS those benefits continue for several hours post therapy.

Vibration systems generating compressive loads have historically been the reason for the perceived detrimental concerns of vibration therapy. Compressive loads inflict accelerated wear on native joints predisposing to arthritis. The neurological effects of repetitive compression loading have been well documented. Such effects as compressive neuropathies at the wrist presenting as carpal tunnel syndrome or cubital tunnel syndrome at the elbow are undesirable.

Non-compressive vibration systems such as the PPTS generate non-percussive multidirectional loads to bone cells and surrounding tissues. These loads are sufficient to load the bone cells, accelerating their metabolism without detrimental involvement of nerve tissues. There are certainly no documented cases of neurological compromise with the PPTS. By generating cycloid vibrations in all therapy modes, the PPTS stimulates cellular metabolism with acceleration of healing in all body tissues. Enhancement of the flow systems within bone and direct stimulation of bone cells metabolism inducing bone formation and architectural restoration are likely mechanisms by which the Pro personal therapy system modulate the skeletal system to prevent osteoporosis. For these reasons I believe it is important that a clear understanding of the mode of therapy systems are properly understood by the healthcare provider and patients.

Dietary considerations in Osteoporosis

Calcium and phosphorus are the most important elements in the consideration of osteoporosis. The adult human contains 1000g of calcium. Ninety nine percent of this calcium is in the skeleton. Daily calcium intake should amount to 1000mg. Calcium is absorbed intestinally through an active transport system in the duodenum, but also through a passive system in the rest of the small intestine. Sources of calcium are milk and green leafy vegetables such as spinach. One pint of milk contains 750mg of calcium.

The adult human contains 600g phosphorus. Eighty five percent of which is stored in the skeletal system. The daily intake of phosphorus is 800-2000mg, and sixty five percent of this is absorbed through active transport in the intestinal lumen and renal system. Phosphorus is present in meat, grains and dairy products.

Regular weight bearing exercise and a healthy balanced diet should complement the regular use of the PPTS to reduce the risk of osteoporosis.