Topic 5

bioDensity™ Force Production Increase: Clinical Analysis with Over 4,000 Subjects

Force production is the metric that bioDenstiy (bD) uses to measure both stimulus and changes in the body. Increases in force production have been seen by researchers in more than 4,000 test subjects as presented at the American College of Sports Medicine annual conference (Moynes et al. 2013). This paper discusses various human body adaptations resulting from this increase.

Broad Population Benefits

Increasing bone density, greater activation of the central nervous system, and improving the strength and alignment of joints are benefits that improve lives of high performance athletes as well as deconditioned, compromised and elderly individuals. bD use can deliver these positive changes to the body, and do so safely as all forces applied are regulated by the patient/user's own comfort. As a result injuries (and falls) can be reduced/prevented and performance (in athletics or in every day life) improves.

- *Safe - All force/load is self imposed*
- *Accurate & repeatable - Server based ensuring the same experience in all locations*
- *Measured - Performance is measured and compared to norm data*
- *Fast and convenient - 10 min per week, no need for change of clothes*

Bone Density Increases

Forces that briefly bend or compress bones stimulate an adaptive response of bone density growth (Wolff, 1892, U.S. Surgeon General, 2004). This level of force/loading typically requires multiples of an individuals bodyweight (Marcus, 2006). Test subjects produced higher forces than would be seen in conventional fitness environments. bioDensity system collected data (bD server, 2012) demonstrates multiples of bodyweight loading for different populations:

- *Athlete Population - 75th percentile bD Leg Press for males ages 20 to 29 (n=279) is 2,790 lbs./1,268 kg.*
- *Adult Population - 50th percentile bD Leg Press for males ages 40 to 49 (n=380) is 2,031 lbs./923 kg.*
- *Aging Population - 50th percentile bD Leg Press for females ages 80 to 99 (n=142) is 635 lbs./289 kg.*

The test subjects above had adapted up to these levels of force over 48 bD sessions. Clinical research (n=4,374) has shown force production improvements averaging 6.1% in females and 5.1% in males between sessions 3 and 4 (Moynes et al. 2013). Both the levels of force used and gains in force production capability have corresponded with increases in bone density verified by DXA scans (Jaquish et al. 2012).

Neurological Amplification

The bD system isolates optimal biomechanical positions, allowing the greatest amount of tissue activation. These positions have been identified through analysis of force production and motor neuron engagement (Mookerjee & Ratamess, 1999). When an individual engages large amounts muscular cells in action, the cells work together more effectively over time (Hebb, 1949). Motor learning, begins this way and as the individual repeats and speeds the action, greater neural adaptive responses take place. Rapid neurological changes take place upon the first 4 uses of bD as identified by researchers showing full body force production gains of 9.3% between second and third sessions of bD (Moynes et al. 2013).

Stronger Joints, Reinforced Connective Tissue, and Improved Biomechanics

Similar to bone, compressive forces also improve the density of tendons and ligaments. This reinforcement of tendons and ligaments dissipates stress at joints allowing for greater performance and less pain in movement (Benjamin & Ralphs, 1998). This means bone can realign to optimized biomechanics, improving posture, balance, breathing and lowering chance of injury in the future.

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