

Why Eccentrics?



The Technology of Human Performance

What is it?

Eccentric

adj., departing from the norm, not concentric, utilizing negative resistance for better client outcomes

Eccentrics is a type of muscle contraction that occurs as the muscle fibers lengthen, such as when a weight is lowered through a range of motion, or when a person walks downhill. The contractile force generated by the muscle is weaker than an opposing force, which causes the muscle to stretch.

Also known as “negative” contraction, eccentric muscle work provides unique responses and benefits compared to conventional exercise:

- Muscles resist force rather than produce it, requiring 80% less oxygen compared to concentric work
- Low perceived exertion, so clients comfortably produce higher force output than in traditional concentric exercise
- Body can resist 30-40% more weight eccentrically than it can push concentrically
- Eccentric training helps enhance concentric abilities
- Eccentric training promotes muscle growth and strength
- High load eccentrics deliver proven benefits, including faster responses and greater workloads
- Specificity of exercise, from ADLs to sports performance, offers a means to training for functional activities, including descending stairs, lowering loads, jumping, deceleration, etc.

Eccentric training **builds up type II (fast twitch) muscle fibers**, for:

- Enhanced overall athletic performance – power, “spring quality,” reaction, agility
- Improved stability in stair descent and standing balance
- Increased functional control and performance in activities of daily living



The Research

Muscle Response to Eccentric Work

Eccentric Muscle Contractions: Their Contribution to Injury, Prevention, Rehabilitation, and Sport

J Orthop Sports Phys Ther 2003; 33:557-571
LaStayo PC, et al

“The muscle-tendon structure also responds favorably to an eccentric-resistance protocol. These adaptations...play a part in the enhancement of high-power sport activities, the prevention, and the rehabilitation of sport injuries and non-sport musculoskeletal impairments, especially those that afflict the elderly.”

Do Muscles Function as Adaptable Locomotor Springs?

Journal of Experimental Biology 2002; 205:2211-2216
Lindstedt SL, et al

“Lengthening (eccentric) contractions result in the greatest muscle forces at the lowest relative energetic costs. Eccentric contractions play a key role in storing elastic strain energy which, when recovered in subsequent contractions, has been shown to result in enhanced force, work or power outputs.”





Negative is the new positive

Eccentric Benefits for Joints

The Use of Eccentrically Biased Resistance Exercise to Mitigate Muscle Impairments Following Anterior Cruciate Ligament Reconstruction: A Short Review

Sports Health: A Multidisciplinary Approach 2009; 1:31
Gerber JP, et al

"Compared to standard rehabilitation, adding an early 12-week eccentric resistance training program 3 weeks after ACL reconstruction safely and dramatically improves quadriceps and gluteus maximus volume strength, and hopping ability measured at 15 weeks and at 1 year following surgery."

Effects of Early Progressive Eccentric Exercise on Muscle Structure After Following Anterior Cruciate Ligament Reconstruction

J. Bone Joint Surg Am 2007; 89:559-570
Gerber JP, et al

"Eccentric resistance training implemented three weeks after reconstruction of the anterior cruciate ligament can induce structural changes in the quadriceps and gluteus maximus that greatly exceed those achieved with a standard rehabilitation protocol."

Early Application of Negative Work via Eccentric Ergometry Following Anterior Cruciate Ligament Reconstruction

J Orthop Phys Ther 2006; 36(5): 298-307
Gerber JP, et al

"Negative work via eccentric ergometry can be both safe and efficacious early after ACL-R."

An Eccentrically Biased Rehabilitation Program Early After TKA Surgery

Arthritis Volume 2011; 2-10
Marcus RL, et al

"Utilizing...an eccentrically-biased rehabilitation program early after total knee arthroplasty contributed to changes in physical function to norm-based levels. The potential impact on best-practice rehabilitation following TKA is for reaching as greater focus on quadriceps strengthening is feasible and may be capable of optimizing outcomes."

Safety, Feasibility, and Efficacy of Negative Work Exercise via Eccentric Muscle Activity Following Anterior Cruciate Ligament Reconstruction

J Orthop Sport Phys Ther 2007; 37(1): 10-18
Gerber JP, et al

"Negative work exercise (via eccentric muscle activity) has the potential to be highly effective at producing large quadriceps size and strength gains early after ACL-R. Negative work output increased systematically throughout training, while knee and thigh pain remained at relatively low levels. The addition of negative work exercise also induced superior short-term results in strength, performance, and activity level after surgery."

Geriatric & Cardiopulmonary

When Active Muscles Lengthen; Properties and Consequences of Eccentric Contractions

News Physiol Sci 2001; 16:256-261
Lindstedt SL, et al

"Eccentric exercise, which requires minimal energy and thus oxygen support, may be ideally suited for an aging population for rehabilitation as well as increasing both strength and power in all individuals."

The Positive Effects of Negative Work: Increased Muscle Strength and Decreased Fall Risk in a Frail Elderly Population

Journal of Gerontology: MEDICAL SCIENCES 2003; 58A(5): 419-424
LaStayo PC, et al

"These data demonstrate that lower extremity resistance exercise can improve muscle structure and function in those with limited exercise tolerance. The greater strength increase following negative work training resulted in improved balance, stair descent, and fall risk only. Because low energy cost is coupled to high force production with eccentric exercise, this intervention may be useful for a number of patients that are otherwise unable to achieve high muscle forces with traditional resistance exercise."

Eccentric Ergometry: Increases in Locomotor Muscle Size and Strength at Low Training Intensities

Am J Physiol Regulatory Integrative Comp Physiol: R1282-R1288, 2000
LaStayo PC, et al

"Many elderly individuals with cardiovascular disease cannot exercise at intensities sufficient to provoke improvement in skeletal muscle mass and function... (these patients) could, at the very least, maintain their muscle mass and perhaps even experience an increase in muscle size and strength using an eccentric biased exercise rehabilitation."

Muscle Damage and Muscle Remodeling: No Pain, No Gain?

J Experimental Biology 2011; 241:1-6
Flass KL, et al

"Increase in muscle size and strength can be achieved independent of any symptoms of damage...eccentric exercise regimes might be perfectly suited for these elderly exercise-intolerant individuals because of the low energy requirements and high force-production abilities of eccentric muscle contractions."

Chronic Eccentric Exercise: Improvements in Muscle Strength Can Occur with Little Demand for Oxygen

Am. J. Physiol. 276 (Regulatory Integrative Comp. Physiol. 45): R611-R615, 1999
LaStayo PC, et al

"The strength enhancements with eccentric training in our study, with very minimal cardiac demand, may have profound clinical applications. The strength improvements...occurred despite the eccentric training requiring the same or less V02"





Elderly Patients and High Force Resistance Exercise – A Descriptive Report: Can an Anabolic Muscle Growth Response Occur Without Muscle Damage or Inflammation?

J Geriatric Phys Ther 2007; 30(3):128-134
LaStayo P, et al

“Elderly individuals participate in resistance exercise to induce an anabolic response and grow muscle to help overcome functional deficits...It is important to note that resistance exercise biased towards eccentric muscle contractions can induce high muscle forces while at low metabolic costs.”

Metabolic Conditions

Increased Strength and Physical Performance with Eccentric Training in Women with Impaired Glucose Tolerance: A Pilot Study

J Women's Health 2009; 18(2):253-260
Marcus RL, et al

“Eccentric resistance exercise is an easily tolerated yet potent intervention that can potentially mitigate worsening physical function and mobility-related consequences of sarcopenia in aging women.”

Comparison of Combined Aerobic and High-Force Eccentric Resistance Exercise with Aerobic Exercise Only for People with Type 2 Diabetes Mellitus

Phys Ther 2008; 88(11):1345-1354
Marcus RL, et al

“Utilizing eccentric resistance exercise may be ideally suited to maximum lean tissue outcomes, at a fraction of the cardiovascular cost of concentric and isometric resistance exercise.”

Parkinson's Disease

High-Intensity Negative Work Reduces Bradykinesia While Improving Balance and Quality of Life in Persons with Parkinson's Disease

Journal of Neurologic Physical Therapy 2004; 28(4):173
Dibble LE, et al

“Persons with Parkinson's Disease demonstrate reduced bradykinesia and improvements in their balance function and physical components of quality of life as a result of high intensity lower extremity negative work.”

The Safety and Feasibility of High-Force Eccentric Resistance Exercise in Person with Parkinson's Disease

Arch Phys Med Rehabil 2006; 87:1280-2
Dibble LE, et al

“Persons with mild to moderate PD can safely and feasibly participate in high-force eccentric resistance training...This type of exercise...may be ideally suited for subjects with PD because high levels of muscle force are generated with low metabolic demands.”

High-Intensity Resistance Training Amplifies Muscle Hypertrophy and Functional Gains in Persons with Parkinson's Diseases

Movement Disorders 2006; 21(9): 1444-1452
Dibble LE, et al

“Persons with Parkinson's Disease in this study who performed high-force eccentric resistance training demonstrated...increases in muscle volume (that) appears to be important in improving muscle force and mobility in persons with PD.”

The Result

Presenting Eccentron™ from BTE

Eccentron is the unique new eccentric resistance strength trainer. Until now, providing the research-proven benefits of eccentric strength training to a broad range of populations in an easy to use, safe, closed chain manner has not been possible. Eccentron changes that.

Eccentron is not a bicycle, stepper, or elliptical trainer. Harnessing negative resistance allows clients to efficiently strengthen and stabilize joint structures for increased stability, balance, and overall performance. Eccentron combines the power of eccentrics with BTE objective dosing, performance, and progress tracking – for superior outcomes.

Eccentron was invented by a team of University research doctors – a physical therapist, a biologist, and an MD, with clinical research funded by the National Institutes of Health. Now it's brought to you by industry leader BTE.



General Rehab, Athletic, Geriatric, & Cardiopulmonary clients all benefit from eccentric exercise

ECCENTRON

ECENTRON IS
REVOLUTIONARY
LOOK FAMILIAR? THINK AGAIN.

It is not an elliptical, stepper, or bike. Eccentron is a patented, functionally unique **eccentric strength training system**. It is unlike any therapy or athletic conditioning tool you have seen or used before. And its results are unlike any you've ever seen before.

Harness the power of negative resistance for positive results with BTE Eccentron.



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