GFIT TECHNOLOGY:
The Potential for Ergogenic Gain

A DISCUSSION OF PROPOSED MECHANISMS AND CURRENT RELATED RESEARCH

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Oxysox, with graduated compression (GFIT) technology, have recently become popular among elite and advanced runners. GFIT technology, used as an ergogenic aid to athletic performance, has been utilized by an impressive, growing list of premiere athletes including runners and cyclists, as well as NBA, NFL, and NHL players.

A basic comprehension of the human venous circulatory system is necessary in understanding how GFIT technology may impact athletic performance. The "calf muscle pump" is the body's primary mechanism for returning blood to the heart. With each step, the calf muscle contracts, forcing blood to move through the veins and back to the heart. This process allows for a continuous supply of freshly oxygenated blood. It also removes metabolic waste products from muscle where they can accumulate, ultimately impeding performance, causing pain, or slowing recovery.

The firm compression found in Oxysox is "graduated", meaning higher pressures are built into the foot and ankle, with tapering pressures towards the top of the sock. The result is a firm, supportive fit that literally propels blood back to the heart more efficiently than a healthy calf muscle can do on its own accord. GFIT technology results in approximately a 14% improvement in calf muscle pump efficiency. Case in point; healthy study subjects without compression socks have measurable swelling in the lower leg in as little as five minutes of standing. Oxysox eliminate or reduce that "normal swelling", indicating their ability to augment even the most healthy calf muscle pump.

It is interesting to note that over half the population has some measure of malfunctioning in their venous system (such as varicose veins), with women accounting for a two to one ratio over men. This ultimately causes excessive pooling of blood in the venous system, often resulting in swelling, pain, and fatigue. Not surprisingly, over 60% of the population complain of these symptoms.

Several theories have been proposed on how GFIT technology may enhance performance through either physiological or biomechanical support of the lower extremities. Proposed mechanisms include:

1. Improved oxygen delivery to the muscles
2. Improved elimination of metabolic waste products from the muscles

3. Reduction of plasma loss from circulation (plasma volume shift) that occurs normally during exercise
4. Stabilization of the lower leg with compression may reduce wasted muscle motion and increase the efficiency of human movement
5. Increased proprioception may also improve exercise efficiency by improving balance

If GFIT technology were to offer competitive advantages, research should demonstrate supportive documentation of one or more of the above mechanisms. We would expect to see specific parameters related to these mechanisms improve, including:

1. Improved RPE (rating of perceived exertion)
2. Improved Aerobic Capacity (VO2Max)
3. Fatigue reduction
4. Improved power production
5. Reduction in heart rate with exercise
6. Reduction in lower leg edema
7. Increased plasma volume shift back into circulation
8. Reduced serum creatine kinase as an indicator of reduced muscle damage
9. Reduction in post exercise muscle pain
10. Improved proprioception

The following research (exhibit A) provides evidence that the graduated compression found in GFIT technology may, indeed, positively impact each of the above parameters. In conclusion, though there is limited research to support GFIT technology as an ergogenic aid to athletic performance, the exact mechanism(s) have not been clearly defined. Continuing research will be required to specifically define the competitive advantages of GFIT technology.

EXHIBIT A

1. Oxysox Pilot Study, James Pivarnik, Ph.D., Michigan State University, Human Energy Research Laboratory. July, 1995
Findings: Healthy college student subjects demonstrated a 2-2.5% increase in VO2Max with Oxysox.

2. "The Effects of Graded Compression Elastic Stockings on the Lower Leg Venous System During Daily Activity", Buhs CL, Bendick PJ, Glover JL, Journal of Vascular Surg., 1999. 30: 830-35
Findings: Vein caliber decreased with use of compression stockings, as did subjective pain.

3. "Influence of Compression Hosiery on Physiological Responses to Standing Fatigue in Women", Kraemer, Med. Sci. Sports Exerc., 2000, Vol 32, NO 11, PP 1849-1858
Findings: Compression hosiery may minimize edema and muscle damage (as evidenced by decreased creatine kinase levels) in standing women, with a resulting increase in comfort. Leg power and jump height also improved.

4. "The Influence of Graduated Compression Stockings on Heart Rate During and Muscle Soreness Following Continuous Fast Paced Road-Running", A.Ali, B.G. Snow, and M.P. Caine, Sports Technology Research Group, Loughborough University, Loughborough, LE11 3Tu, UK
Findings: Subjects wearing compression socks demonstrated reduced muscle soreness and increased jump height post exercise. Participants also ran faster with a lower heart rate and had a lower level of perceived exertion post exercise.

5. "Influence of Compression Garments on Vertical Jump Performance in NCAA Division 1 Volleyball Players", Kraemer, J. Strength and Cond., Res. 10(3): 180-183.1996
Findings: Use of compression shorts in highly skilled jumpers may have value for enhancing power output over repeated jumps.

6. "Non-Prescription, Padded, Lightweight Support Socks in the Treatment of Mild to Moderate Lower Extremity Venous Insufficiency", Jack R. Brown D.O., JAOA, Vol 95, NO 3, PP 173-181, 1995
Findings: Light compression socks (6-12mm/Hg) relieve symptoms of edema, numbness, pain, and cramping associated with varicose veins.

7. Journal of Occupational and Environmental Medicine; 39(9): 889-894
Findings: 43% of standing workers in compression socks showed a decrease in leg swelling versus those that stood on rubber work mats. 50% of workers without compression socks and on rubber mats showed an increase in swelling.