



KYMIRA Recovery Summary

The following is a short scientific summary of how specific benefits of KYMIRA products impact recovery from intense exercise.

Enhanced Physiological Response

Increased Circulation

Exposure to infrared (IR) has been shown to increase Nitric Oxide (NO) levels in exposed tissue (Leung et al, 2008), NO has been shown to cause vasodilation (Klabunde, 2010) which results in an increase in circulation for the wearer. Increased levels of tissue oxygen has been well documented to aid with recovery from tissue damage (McClue, 2005). The results of increased circulation for recovery are more oxygen and rich nutrients are absorbed into your cells (Bieuzen et al, 2012) due to the increased availability. The initial results from this will be the breakdown of lactic acid, and ridding the body of any waste quicker. The increase in blood circulation aids in replenishing muscle glycogen levels to reduce inflammation, thus speeding the healing process (Bangsbo & Hellsten, 1998). Circulation is increased naturally after exercise, however the infrared properties of KYMIRA will maintain an increased blood circulation thus allowing your body to recover faster.

Thermoregulation

To perform any activity at peak levels, the body must be in optimal condition and provide an ideal environment for metabolic processes necessary to complete that task (Laursen, 2011) this includes recovery. A major factor in this is temperature and the body's ability to regulate temperature so that chemical reactions are not hindered. Mechanical testing has shown that KYnergy fabrics will heat to an optimum temperature quicker than standard fabrics and then retain heat 63% longer when exposed to a colder environments. This means that when worn in cold conditions, the KYnergy fabrics will help the wearer to maintain an optimal body temperature. As mentioned above, the increase in circulation aid the body's natural ability to thermoregulate so that it does not become too hot.

In addition to the thermoregulatory benefits of increased circulation, the Kynergy fabrics are also able to help cool the wearer in hotter climates as they are 35% quicker drying than other baselayers on the market. IR reacts with sweat to accelerate the rate of evaporation and dispel heat. These quick drying properties are also beneficial in cold, wet climates as drier fabrics are able to stay closer to an optimal temperature when exposed than wet ones. In terms of recovery, keeping cool will



allow for the metabolic processes of breaking down lactic acid and transporting oxygen to the muscles is maintained.

Increased Tissue Oxygen Levels

Increased levels of tissue oxygen has been well documented to aid with recovery from tissue damage (McClue, 2005). Hyperbaric oxygen chambers are used to achieve ~10% increase in tissue oxygen levels. KYMIRA products have been shown to lead to a 20% increase in TCPO₂ readings for tissue oxygen levels when compared to control garments.

Pain Relief

While pain may not inhibit recovery, it is often most abundant when not exercising and therefore in a recovery period. The immediate benefit to any athlete will be a significant reduction in DOMS (Kraemer et al, 2001). This will be greatest when KYMIRA apparel is worn during exercise and recovery but wearing for only one or the other will still be beneficial. The pain alleviating effect is achieved through the utilisation of the same metabolic pathway as those used when taking opiates (Burke, 2009). When an opiate such as morphine is taken, the morphine molecules bind to the nerve cell receptors, which causes a release of nitric oxide (NO). NO then goes on to activate Cyclic Guanine Mono-Phosphate (cGMP), which mediates the diminution in pain (Duarte and Ferreira, 1992). Infrared exposure, in particular FIR exposure causes an increase in NO levels in exposed tissues (Leung et al, 2008), essentially by-passing the need for drugs. Relief of pain from chronic conditions such as an old injury can also enhance an athlete's performance (Davies et al., 2009), even if only due to reduced psychological inhibition. Caution is advised when using KYMIRA products to alleviate injury related pain as it will not be an instant cure and athletes should not ignore professional advice to allow their bodies to heal.

Increased Cellular Metabolism and Rates of Cellular Growth, Repair and Replication

Research has shown that exposure to IR will dissociate NO from the enzyme Cytochrome-C Oxidase which is a transmembrane protein found in mitochondria. While the dissociated NO is of benefit for reasons previously discussed, its removal from the active site if Cytochrome-C Oxidase activates the enzyme accelerating the rate at which it completes the electron transfer chain to establish transmembrane potential to produce ATP. Due to this increased cellular metabolism, cells have been shown to grow, repair and replicate quicker (with no carcinogenic effects observed). This results in tissue damage due to training repairing quicker, enabling the athlete to be ready for peak performance sooner. IR has also been shown to dramatically improve the rate at which soft tissue



wounds heal and similar mechanisms as observed in Toyokawa et al. (2003) can be applied to recovery from sporting injury and tissue damage.

Closing statement

While many benefits of wearing KYMIRA apparel will enhance recovery on a one off basis after, the greatest benefits will be achieved through prolonged use of KYMIRA products during exercise and recovery. The combined performance and recovery enhancing benefits will allow the athlete to increase work output/capacity for work over 'x' period of time as they will be able to push themselves harder, while maintaining greater performance and then recover quicker. The psychological benefits of realising these enhanced recovery benefits will effect the athlete in the long term.

References

- Bieuzen et al. (.2012). Recovery after High-Intensity Intermittent Exercise in Elite Soccer Players using VEINOPLUS Sport Technology for Blood-Flow Stimulation. *Journal of Athletic training*, 47 (5), 498-506.
- Burke, T. (2009). *Nitric oxide and relief of pain*. Retrieved August 12, 2012, from <http://www.diabetesincontrol.com/component/content/article/64-feature-writer-article/8201-nitric-oxide-series-part-seven-nitric-oxide-no-and-relief-of-pain&Itemid=8>
- Bangsbo, J., & Hellsten, Y. (1998). Muscle blood flow and oxygen uptake in recovery from exercise. *Acta physiologica Scandinavica*, 162(3), 305-312.
- Davies, V., Thompson, K. G., & Cooper, S.M. (2009). The effects of compression garments on recovery. *Journal of Strength and Conditioning Research*, 2 (17), 86–94.
- Gladden, L. B. (2004). Lactate metabolism: a new paradigm for the third millennium. *The Journal of physiology*, 558(1), 5-30.
- Gordon and Coyle. (2011). Transcutaneous Oxygen Tension as a Primary Endpoint to Assess the Efficacy of an Optically Active Vasoactive Garment.
- Klabunde, R. E. (2010). *Cardiovascular Physiology Concepts*. Retrieved 09 02, 2012, from <http://www.cvphysiology.com/Blood%20Flow/BF011.htm>
- Kraemer WJ, Bush JA, Wickham RB, et al. (2001). Continuous compression as an effective therapeutic intervention in treating eccentric-exercise-induced muscle soreness. *Journal of Sport Rehabilitation*, 10, 11-23.
- Laursen, P.B. (2011). Long distance triathlon: demands, preparation and performance. *Journal of human sport and exercise*, 6 (2), 247-263.



Leung et al, T.-K. (2008). Far Infrared Radiation Induces Intracellular Generation of Nitric Oxide in Breast Cancer Cells. *Journal of Medical and Biological Engineering*, 29(1), 15 - 18.

McClue. (2005). Holofibre Study of 13 Healthy Subjects.

Worobets et al. (2014). Effects of FIR Athletic Apparel on Oxygen Consumption During Exercise.