MOXY

CASE STUDY

Return-to-play:

Rehabbing a Fractured Tibia Plateau, Torn Meniscus, and Sprained MCL/ACL

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By Aaron Davis, Founder & Owner of Train, Adopt, Evolve

Executive Summary

According to the CDC and major research institutions, injury rates from sports participation, including youth, college and professional, are on the rise. Concerns for the long-term health and ongoing performance of the athlete has elevated injury recovery, or Return-to-play (RTP), to the major focus for trainers across all levels of play.

Return-to-play decisions are fundamental to the practice of sports. The unfortunate reality is an athlete returning to their respective sport is expected to return performing at or above the level in which they were playing preinjury. With this in mind, we've set our sights on integrating new ways of leveraging physiological variables based on the latest technologies, even when those variables sit outside our current perspective.

The Challenge

Early May 2018, Train, Adapt, Evolve was contacted to work with a prospective D1 level high school male football/basketball athlete coming off of surgery for a fractured tibia plateau, torn meniscus, and sprained MCL/ACL.

Understanding the demands of the competition schedule, it was clear the athlete would be competing weekly from August through the beginning of March participating in 11 football games and 30+ basketball games. Coaching In the private sector means load management isn't an option once the competitive season begins; the preparation plan took this into account.

After our evaluation, we concluded the need to improve:

- Intramuscular Coordination between the Muscles.
- Reactive and Maximal Strength
- Symmetrical Strength Bilaterally
- Acceleration and Deceleration
- Agility

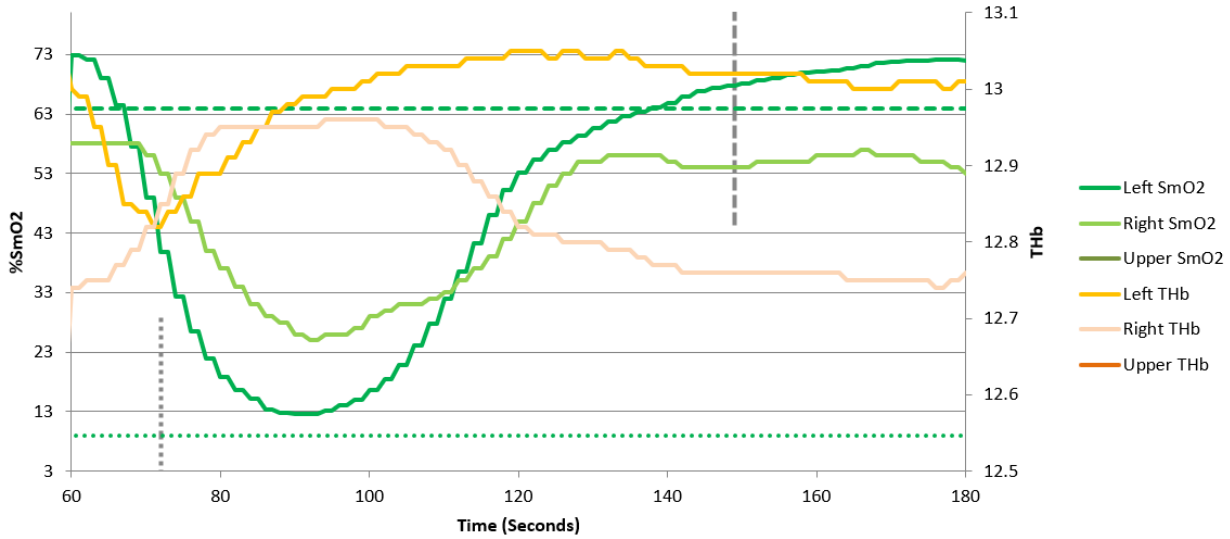
Additionally, through various recovery protocols we would need to develop the general and specific structures that promote delivery (RBC, microvascular, cardiac, etc.) and utilization (Mitochondria - glycogen/glucose oxidation) of muscle oxygen.

Physiological Assessment

We started out with our **Moxy RIP*** evaluation created by Brian Kozak of Next Level SP**.** Since the athlete was early in his recovery activity, we used a spin bike which created an environment to challenge the nervous system in a unique way by driving contraction/relaxation cycles via RPM's during each interval. This gave us insight into how the intramuscular coordination was organized.

We monitored this by keeping our eye on the tHB (Blood Flow) trends with muscle compressions being ideal and venous and arterial occlusions being counterproductive in terms of O2 delivery to the muscle. Generally venous and arterial occlusions occur under two circumstances and based on an athlete's strength capacity. Stronger athletes tend to create large amounts of muscle tension causing occlusion trends; weaker athletes will increase intramuscular recruitment as an emergency to overcome an effort - which also will cause occlusions.

Our athlete had atrophy and a strength deficit on the injured leg. This deficit created a compensated intramuscular recruitment strategy that created a venous occlusion when the muscular force and contraction/relaxation cycles became too demanding.



During the RIP evaluation we tracked how well oxygen is being utilized during the high intensive efforts - monitoring SMO2 reaction during each bout. As we see by the graph, the right injured leg has a venous occlusion (beginning approximately at the 60 second mark) and does not utilize O2 as efficiently as the left - we also see low tHB trends. This generally happens when muscle atrophies, losing not only the muscle tissue itself but also the microvascular structures that support the tissue.

***Moxy RIP** - The **R**ecovery **I**ntensity **P**rofile Assessment measures an athlete's ability to use oxygen during repeated all-out loads, measures their ability to recover between loads, and measures how their physiology responds as they fatigue after multiple loads. It is used to determine what aspect of the athlete's physiology limits their performance during this type of work so they can adapt their training to improve most effectively*.

Solution

Our objective for the athlete during rehab was to first work on the fundamentals. Utilizing single leg exercises, targeting 1x Bodyweight or more on each leg. In combination with the single leg work we also used a form of blood flow restriction training without using a cuff by manipulating his breathing to create a similar reaction. The workout was closely monitored using Moxy attached alternately between workouts on Vastus Lateralis and Rectus Femoris. This workout is done on both legs to keep the fast twitch fibers reasonably conditioned in the healthy leg given the speed and power demands of his chosen sports.

A second now standard oxygen-based intervention was used to increase vascularization. A form of High Intensity Interval Training (HIIT), we performed the customized protocol on a spin bike designing time frames specific to the athlete - RPM frequency, duration, and recovery based on real time data using Moxy.

There are two reasons for using HIIT in this case. First, to create the needed reaction for adaptation. Second, to understand and establish metrics identifying when the tissue can no longer handle loading. Ultimately, this allows us to mitigate residual fatigue day-to-day and increase the density of training which in our opinion fast tracks the athlete back to competition.

Once the athlete achieved our fundamental objectives, we then integrated his football specific skill work into the Moxy HIIT sessions allowing us to keep the load in an area where we knew adaptation could be fast while also keeping a highly motivated athlete from doing too much too soon (which in itself could be a big reason for the injury/reinjury cycle we see specific to knee injuries).

Results

As of this writing, the athlete has successfully completed the 2018 football season and is 15 games into the basketball season. Further longitudinal assessments have shown no regression in development or performance and in fact reevaluation of the RIP assessment confirms balance with improvements in both blood flow and utilization.

About Moxy Monitor:
The Moxy, designed and manufactured in Hutchison Minnesota, is a small, wearable sensor that utilizes infrared light to continuously monitor oxygen saturation (SmO_2) levels in the

muscles of elite athletes while they exercise. Designed to measure the percentage of hemoglobin-and-myoglobin-carrying oxygen in the capillaries and cells of muscle tissue, it helps trainers ensure that protocols for warming up, limiter and recovery assessments, real time training, and return-to-play procedures, are based on each individual athlete's physiology.

About Train, Adapt, Evolve:

Train, Adapt, Evolve, located in Austin Texas, leads the health and human performance revolution with its integration of technology, data analytics, movement rehabilitation, nutrition, and comprehensive strength and conditioning principles. We are committed to providing the best individualized experience to athletes, coaches and fitness enthusiasts through their journey to find true health and performance.