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Improving fitness for sprints and stop-and-go sports - the scince

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Sprinting demands a high rate of energy production to cover the power output of muscles working at maximum intensity. Failure to match the rate of energy expenditure with energy production within muscle cells results in fatigue. Single short sprints rely almost entirely on two fuels – muscle glycogen and phosphocreatine (PCr) – to rapidly replace the ATP used during this type of maximal exercise. For example, during a 6-10 s sprint, the rapid rate of ATP resynthesis is covered equally by the anaerobic degradation of muscle glycogen in the glycolytic pathway and PCr breakdown. Prolonging a single sprint or engaging in stop-and-go sports that require multiple-sprints makes an ever-increasing demand on aerobic metabolism to replace ATP in working muscles. During prolonged periods of multiple sprints of short duration (e.g. 6-10 s), PCr stores are replenished during short recovery periods, while muscle glycogen is replaced by nutritional intervention after exercise [1].

Sprinting demands the recruitment of both the fast and slow contracting muscle fibers and training leads to recruitment patterns that bring the fast fibers into action rapidly. Adaptations to sprint training can be considered under three headings, namely muscle fiber recruitment, strength and metabolic efficiency. Resistance training improves strength by increasing the recruitment of a larger muscle mass and by increasing the size of muscle fibers. Strength and speed translate into the 'power' needed to compete in multiple-sprint sports. The metabolic adaptations of muscle improve the anaerobic degradation of muscle glycogen so that ATP can be formed more quickly while also improving the buffering capacity to deal with the accumulation of hydrogen ions that accompany lactate formation during this energy producing process. During short recovery periods between multiple sprints, PCr resynthesis relies on adequate oxygen consumption. Failure to replace the PCr stores before the next sprint results in a decrease in power output that translates into a decrease in sprint speed and hence distance covered. As the number of brief sprints increase, so aerobic metabolism makes an increasing contribution to energy production; this is usually accompanied by a gradual decrease in power output. So one commonly used strategy is to train to improve the capacity for sprinting at less than maximum pace along with training to improve maximum sprint speed. Although everyone improves with sprint training, the rate of adaptation and ultimate achievements depend on several factors, including the athlete's genetic characteristics [1].

This presentation will describe training programs that have proved effective in training elite "stop-and-go" athletes, including the American League and National League Rookies of the Year, MLB Batting Champion, NBA All-Stars, WTA Grand Slam Champions, NFL All-Pros, PGA Champions, and many more. In addition, the presentation will summarize the concepts involved in functional training for sport that lead to innovative and specific exercise prescriptions for stop-and-go athletes.

Training programs for selected athletes will be outlined. Specific movement preparation routines are designed to increase core temperature while actively elongating the muscles, activating the stabilizers and proprioceptors, and properly sequencing the forthcoming motor skills necessary for preparation or competition. Movement skills for stop-and-go sports will be reviewed with emphasis on improving the biomechanics, motor programming, and development of linear and multi-directional speed. Development of linear speed requires enhancement of the start, acceleration, transition, absolute speed, and speed endurance. Improvement of multi-directional speed involves teaching the sequential general skills, including lateral and base movements, cross-over movements, cutting (power and speed), and backpedaling, and then progressing to special and very sports-specific pre-programmed and random skills. Specific types of muscular strength (the Performance Contractile Continuum), ranging from stabilizing strength to propulsive strength, must be improved to support the required motor skills. It is also important to enhance the elastic (stretch-shorten cycle) continuum, including rapid response, short response, long response, and very long response movements. Innovative protocols for developing energy systems range from complementary non-impact, high-speed movements on both dry land and hydrotherapy environments to sport-specific and motor ability-specific applications.

Optimal performance training programs also require effective and ethical regeneration/recovery protocols. These protocols include basic nutritional strategies, athlete-specific and sport-specific dietary supplementation regimens, hydrotherapy, hot/cold therapies, sleep strategies, psychological recovery, and lifestyle skills.

References:

1. Borg, G.A. Psychophysical bases of perceived exertion. Medicine and Science in Sports and Exercise / G.A. Borg. – 1982. – 381 p.