THERAPEUTIC MODALITIES IN RECOVERY PHASE TO ENHANCE ATHLETIC PERFORMANCE

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ABSTRACT

Athletic performance within training or competition requires high physiological demand. Fatigue is one of the normal responses the body experiences due to the demand. It can be in form of metabolic, neural psychological or environmental fatigue. Athlete and couch need to comprehend the physiological basis of training and recovery so that fatigue will not hinder athletic performance. Therapeutics modalities are among the recovery techniques which can be employed to enhance athletic performance mainly by (i) promoting the elimination of biochemical waste product, (ii) improving physiological adaptation to training program and (iii) contributing to injury rehabilitation and prevention. Therapeutics modalities discussed in this paper include massages, active recovery, hydrotherapy (water immersion and contrast bath), compressive garment, electric muscle stimulation and acupuncture/acupressure. Athlete and couch can integrate therapeutic modalities with nutritional, hydration and psychological recovery program. In conclusion, the recovery program with "holistic" approach including the use of therapeutic modalities which is integrated within appropriate training methods increases athlete opportunity to have the best athletic performance.
Key words: therapeutic modalities, recovery

INTRODUCTION

The competiveness level of athletic competition during recent years has been escalated. This situation may due to a multitude of factors, but the main reason is that there is an increase knowledge and understanding of scientifically based training programs focused on improving performance as well as recovery techniques (Bangsbo *et.al*, 2006). Indonesian regression of athletic achievement in regional or international competition might be due to the fact that Indonesian athlete and couch have not optimized science and technology during training and recovery program (Rakaryan, 2011).

Ideally, training and recovery program should be integrated because theoretically athletic performance can be increased by SAID (specific adaptation

imposed demand) mechanism through training and appropriate recovery technique (Lattier *et.al*, 2004). Unfortunately some of the athlete and couch tend to limit the use of recovery techniques during training because the perception that intensive recovery program waste time and resource with minimal benefit. There is also misconception that recovery is only needed when the injury is occurred. Some of athlete and couch has not realized that recovery strategies have more benefits for athletes than merely as tools to assist with rehabilitation (Sirotic *et.al*, 2007). Not many coach and athlete perceive recovery as an important tool prevent the athlete from "burn out", preventing injury and even to create super-compensation when the training program is employed (Noakes, 2000). As the benefit of recovery program has not been well understood, athlete and couch often employed traditional recovery method from anecdotal information rather than from rigorous scientific review.

The aim of recovery is to accelerate the body adaptation to physical and psychological stress (fatigue). It can be done through several approaches includes physiological, psychological, nutritional-hydration and medical-physiotherapy aspects (Bangsbo *et.al*, 2006). The basic principles has two primary roles which are (1) monitoring the athlete's adaptation to training and stress so that appropriate recovery strategies can be determined and (2) the selection of specific recovery techniques and strategies to minimize any residual fatigue from training and competing. To be able to monitor the athlete physiological response and to select the most appropriate recovery technique, coach and athlete should comprehend the physiological basis of training and recovery as well as the recovery techniques which can be employed. In line with this, this paper aims to outline (i) the physiological basis of training, fatigue and recovery and (ii) therapeutic modalities available for recovery program includes massages, active recovery, hydrotherapy (water immersion and contrast bath), acupuncture/acupressure and compressive garment (Hemmings *et.al*, 2000; Cochrane, 2004).

PHYSIOLOGICAL BASIS OF TRAINING, FATIGUE AND RECOVERY

Physiological Basis of Training and Fatigue

In the training program, athletic performance is increased using SAID (specific adaptation imposed demand) principles. As the result, the training program requires high physiological demand to the body thus it creates fatigue as the body`s adaptation to the demand (Noakes, 2000). Training and competition fatigue can be categorized into several main types based on the source of the fatigue which includes metabolic, neural, psychological and environmental fatigue (Noakes, 2000).

Metabolic fatigue result from the imbalances of availability and replenishment energy required to athletic performance. Generally, it is associated with high volumes of training and competition (Krzentowski *et.al*, 2008). **Neural fatigue** results from fatigue of either or both, the peripheral nervous system (PNS) and/or the central nervous system (CNS). PNS fatigue occurs when there are biochemical imbalances in strong ion concentrations or neurotransmitters within the muscle cell, resulting in a reduction of localized force production. CNS fatigue occurs when athlete have inadequate diet for example low blood glucose levels, lacks motivation, or is injured (Lattier *et.al*, 2004). **Psychological fatigue** results from situation within or outside the training and competition program which roots from competition pressures, school exams, home life stresses or financial (Noakes, 2000). **Environmental fatigue** occurs through time spent travelling and dealing with changing weather conditions and time zones. Time spent travelling, particularly through one or more time zones can lead to jet-lag, so additional recovery strategies are needed to address fatigue in these circumstances (Noakes, 2000).

Physiology Basis of Recovery

Without any intervention, generally, the body will attenuate fatigue; however in many cases recovery program is required to accelerate the process and to avoid overtraining, overuse and burnout (Lattier *et.al*, 2004). The main

role of recovery is to help athletes adapt faster to training. This is done by minimizing the effects of training and performance fatigue in order to enable the athlete to “bounce back” and be ready for the next session or match. This process is a critical step in the “overcompensation” model (Calder, 2003). Figure 1 illustrates the role of recovery in accelerating the body adaptation to fatigue.

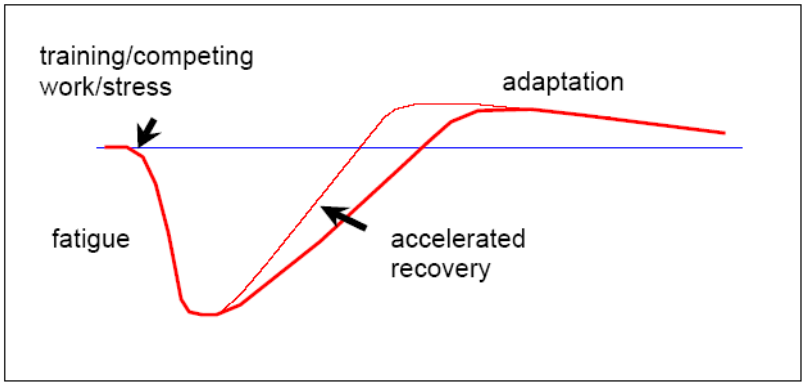

Figure 1. The Basic Principle of Recovery (Calder, 2003)

Basically, recovery is one of the basic principles which should be integrated into training practices. Recovery addresses issues related to training and competition fatigue in order to promote adaptation to training stress (Barnett, 2006). Appropriate recovery program ensures athletes to be able to train hard and improve their performances with a reduced risk of training illnesses and injuries resulted from heavy workloads.

In the practice two challenges faced by couch and athlete is (i) to monitor a athlete's adaptive responses to training and stress and (ii) to manage and encourage adaptation by selecting and applying specific recovery techniques and strategies to offset training and competition fatigue (Calder, 2003). The selection of appropriate recovery program able to create super-compensation mechanism which can elevate the baseline and avoid un-adaptable fatigue illustrated in Figure 2.

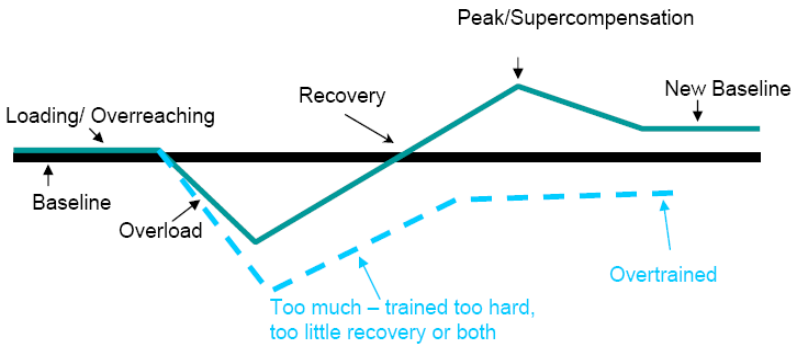

Figure 2. The Mechanism of Recovery to Enhance Athletic Performance (Hornery *et.al*, 2007)

The amount recovery volume and selection of recovery technique depends on the volume and intensity of workloads. Selection of appropriate recovery strategies to address specific types of fatigue will depend on the recovery knowledge of athlete and coach, and on the availability and cost of the strategies identified. Numerous recovery modalities are available but few have been subjected to rigorous scientific examination (Barnett, 2006). Coaches and athlete often depend on anecdotal information from fellow coaches and other athletes for details about recovery techniques and their use.

THERAUPETIC MODALITIES IN RECOVERY

Physiotherapy is one of the approaches which can be incorporated in recovery program. Several therapeutic modalities which can be employed in recovery program includes: massages, active recovery, hydrotherapy (water immersion and contrast bath), acupuncture/acupressure and compressive garment (Barnett, 2006). It has been concluded that therapeutic modalities in recovery program can enhance athletic performance through several mechanism as illustrated in Figure 3.

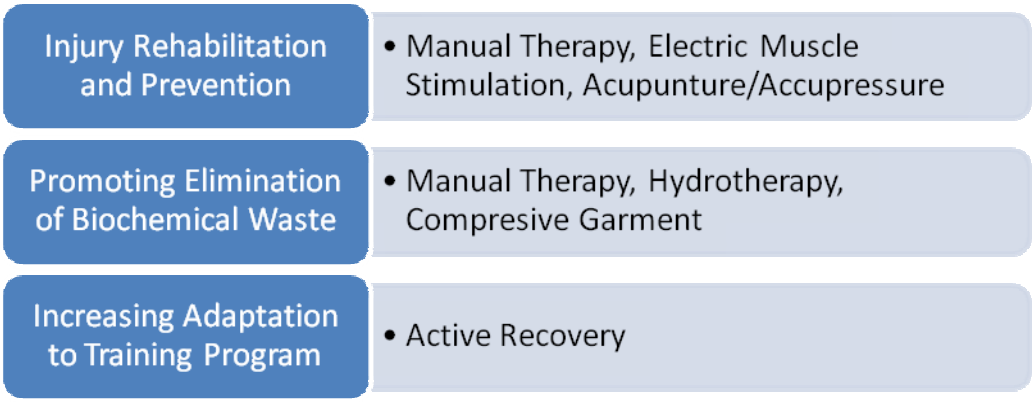

Figure 3. The Mechanism of Therapeutic Modalities in Recovery Program to Enhance Athletic Performance

Massage

Massage is a particularly common recovery modality used by athletes worldwide. It is popular as it is known to promote relaxation and is generally a pleasant or positive experience for the recovering athlete. Sports massage is typically defined as a collection of massage techniques for aiding recovery or treating pathology. Frequently used forms of sports massage include effleurage, petrissage, and deep transverse friction massage (Hemmings *et.al*, 2000).

Effleurage techniques are performed along the length of the muscle, typically in a proximal to distal sequence. Petrissage techniques include kneading, wringing, and scooping type strokes performed with deeper pressure to individual tolerance. Deep transverse friction massage is performed with the fingers moving transversely across the target tissue. Nowadays, specific technique other than the basic Swedish massage technique has been elaborated. Compression massage rhythmic, cross-fiber massage friction technique and trigger point massage are among those techniques (Hemmings *et.al*, 2000).

Compression Massage Rhythmic is a method of compression technique into muscles used to create a deep hyperemia and softening effect in the tissues. It is generally used as a warm-up for deeper, more specific massage work

(Weerapong *et.al*, 2005). *Cross-Fiber Massage Friction* techniques applied in a general manner to create a stretching and broadening effect in large muscle groups; or on site-specific muscle and connective tissue, deep transverse friction applied to reduce adhesions and to help create strong, flexible repair during the healing process (Weerapong *et.al*, 2005). *Trigger Point/Tender Point Massage* combines positioning and specific finger or thumb pressure into trigger/tender points in muscle and connective tissue, to reduce the hypersensitivity, muscle spasms and referred pain patterns that characterize the point (Hemmings *et.al*, 2000).

Several studies have tested the effect of massage on the mood, anxiety and relaxation levels of athletes (Moraska, 2005). Given these positive psychological responses, and the importance of relaxation as one part of recovery, the use of massage may be indicated following heavy performance. A relaxation response is demonstrated by a reduction in resting heart rates, blood pressure and a decrease in excitability of the motor-neuron pool (Robertson *et.al*, 2004). Improved mood states and feelings of well-being have been recorded in several studies and many athletes will use massage as both a means of relaxing physically and psychologically (Weerapong *et.al*, 2005).

In addition to psychological benefit, some studies shows that massage reduces DOMS (delayed onset of muscle soreness), increasing blood flow and lymph flow thus enhance removal of pain substrates that start to accumulate in the injured area, reducing edema (Moraska, 2005). However, most of studies found that massage had no protective effect on muscle strength and ROM. This findings suggest that massage, used appropriately, is beneficial in reducing DOMS and swelling associated with high-intensity eccentric exercise, but according to many studies very little positive effects of massage on recovery of muscle function can be expected. In this case active recovery is the more promising modalities to optimize muscle function recovery (Robertson *et.al*, 2004).

Active Recovery

Active recovery has been recommended for athletes following heavy periods of exercise. The theory is that the active movements when sub-maximal in nature would assist with the rate of post-exercise lactate removal. It also support body adaptation to training then beneficial for “bounce” to super-compensation (Dupont *et.al*, 2004).

Active recovery is can be employed in form of static, balistic, propioceptive neuromuscular function techniques (Martin *et.al*, 1998). Several other type of active recovery has been developed including core stability exercise (Leetun *et.al*, 2004). A recent study examined post-match recovery in rugby athletes measuring creatine kinase. The post-exercise recovery reduction in creatine kinase, and lactic clearance was better than athletes who did a passive recovery (Cabrera *et.al*, 1999). In general, current recommendations for performing an active cool down, and sub-maximal exercise to promote recovery are supported.

Cryotherapy

The use of ice following an acute injury is well supported in the literature and a commonly used practice during rehabilitative exercise and physical therapy. The analgesic effects and initial vaso-constrictive action following ice application are well documented and protocols for the application of ice to an injured or recovering athlete following exercise and return to competition are common (Cochrane, 2004). Further research however is needed before a more definitive recommendation in this area can be made.

Water Immersion (Hydrotherapies)

A wide range of hydrotherapies have been in use restoratively for several thousand years (Cochrane, 2004). Spas, pools, steam rooms, cold pools, and contrast temperature protocols were used by the ancient Greeks and Romans. Researchers demonstrated that underwater massaging (using the jets in a spa)

following plyometrics training helped athletes to maintain leg-explosiveness on the following day. In contrast, passive rest after such training resulted in a significant reduction in leg power. The routine recommended for athlete involves first having a shower, followed bya spa (39 to 40°C) for three minutes and then a cold shower or a plunge into a cold pool (10 to 15 °C) for 30 to 60 seconds (Cochrane, 2004). Warm immersion produces vasodilation of the peripheral circulation and the cold immersion encourages vasoconstriction. Three to five sets of this protocol producing rapid vasodilation and vasoconstriction will accelerate blood flow(Cochrane, 2004). Studies indicated that lactate levels were recovered equally fast by using either the contrast water immersion protocol or the active recovery protocol. Lactate recovery following passive rest was significantly slower. Showering within five to ten minutes at the end of a training session is a good way to accelerate recovery of both lactates and peripheral neural fatigue. Contrasting temperatures can be achieved with a shower and bath at home or the use of a small paddling pool or tub for cold immersion (Cochrane, 2004). The use of contrasting hot water immersion and ice water immersion has been advocated for recovery in athletes.

Compression Garments

Compression garments have been recommended to aid in post-exercise recovery (Barnett, 2006). Several types are worn including graduated compression stockings typically used medically to prevent deep vein thrombosis, compression sleeves to prevent swelling in the limbs or extremities, and elastic tights and exercise clothing worn after training (Barnett, 2006). One study used graduated compression garments during an 80 minute recovery with elevated legs decreased blood lactate concentrations in older trained cyclists and led to a great post-exercise recovery compared to control subjects. The use of compression garment combined with hydrotherapy is found superior compare to solitaire use of these two modalities (Barnett, 2006).

Electrical Muscle Stimulation

Electrical muscle stimulation is used extensively by physical therapists and athletic trainers during the rehabilitation following injury (Barnett, 2006). The electrical muscle stimulation can be used for many reasons and to address multiple goals such as the reduction of swelling, reduction of pain and for neural re-education of injured muscle. Electrical muscle stimulation or (EMS) has been advocated for recovery following vigorous exercise to promote additional muscular contractions which may aid recovery by increasing local blood flow via local vasodilatation as well as via the muscle pump effect from the induced contraction (Barnett, 2006). The use of ice coupled with EMS is used in rehabilitation and is often continued as the athlete makes the difficult transition to the return to play program and eventually the initial stages of competition. Further research is needed before more direct recommendations can be given(Barnett, 2006). Numerous EMS units are available and used by athletes for recovery, however, direct evidence is presently lacking when the desired outcome is solely recovery following exercise training or competition.

Acupuncture and Acupressure

Acupressure is often performed as an adjunct to sports massage but acupuncture requires more extensive qualifications and is less accessible and more expensive than massage (Barnett, 2006). Both acupressure and acupuncture focus on applying pressure or stimulus to specific points located on fourteen meridians (line patterns) on the body. It promotes relaxation as well as contribute to injury rehabilitation and prevention (Barnett, 2006).

CONCLUSION

Every training session is important, as it is an opportunity to become an even better performer. Athletes should aim to start training session or game in a fresh a state as possible so that they can maximize the training benefits and

experiences of the session or event. Recovery strategies are aimed at helping athletes to do this by focusing on reducing residual training fatigue and stress.

Coaches can help educate athletes to understand, plan and use recovery strategies with a view to athletes learning to manage this for themselves. Effective monitoring and recovery management will enable both the coach and athlete to train hard, perform better and more consistently, to reduce training injuries and illnesses, and to develop sound self-management strategies.

Therapeutic modalities such as massages, active recovery, hydrotherapy (water immersion and contrast bath), compressive garment, electric muscle stimulation and acupuncture / acupressure can be integrated in recovery program Several benefits of therapeutic modalities includes (i) promotion of the elimination of biochemical waste product, (ii) improving physiological adaptation to training program and (iii) contribution to injury rehabilitation and prevention. The recovery program with "holistic" approach including the use of therapeutic modalities which is integrated within appropriate training methods increases athlete opportunity to have the best athletic performance.

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