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The Effect of Biofeedback Training on the Arousal of Male Taekwondow Team

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ABSTRACT

Background: To date applied sport psychologists spend much of their time encouraging athletes to develop psychological skills that will enhance their performance**. Background:** The purpose of this research was to study biofeedback training which effects on self-regulation of physiological states, such as sympathetic arousal. The use of peripheral biofeedback is growing rapidly in sport psychology. **Objective:** The aim was to lower competition stress, anxiety, and to have self-regulation. In this research five expert athletes with experience at the country level, received 20 hours of biofeedback training. The effect of this training was explored by the wireless physiological monitoring and feedback system (a Pro Comp and Biograp system). **Results:** The findings indicated: after respiratory training, all athletes developed self-awareness of the Respiration Rate (one of their physiological states). Also they developed self-regulation techniques to decrease their sympathetic arousal. **Conclusion:** The athletes can enhance their sport performance because it gives them new tools for stress managing, arousal and anxiety regulation (according to the result). Research in the field of Biofeedback training provides credible information to athletes, as well as coaches, sport psychologists and other support staff working with the athletes.

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INTRODUCTION

The use of peripheral biofeedback is growing rapidly in sport psychology. The aim is to lower competition stress and anxiety. To date applied sport psychologists spend much of their time encouraging athletes to develop psychological skills that will enhance their performance (Vealey, R.S., 2007; Williams, J.M., 2006)[1, 2]. These skills and strategies enable athletes to develop self-awareness and self-regulation of arousal (Crews, D.J., 2001). The main purpose of all of these psychological skills or strategies is to enable an athlete to perform exceptionally well in the stressful environment of national, international and Olympic level competition (Krane, V., 2006; Mellalieu, S.D., 2006).

To achieve appropriate arousal levels, Biofeedback is often mentioned as a useful means for facilitating the learning of self-regulation by competitive athletes (Blumenstein, B., 2002; Collins, D., 2006; Ravizza, K., 2006). Biofeedback can be a powerful tool for physiological and psychological change, increasing individual awareness and control over the body, reducing habitual stress, improving arousal regulation (Schwartz, M.S., 2003). The most common biofeedback modalities used in sport are heart rate variability, respiration, temperature, EMG, EDR, and EEG. These biofeedback modalities reveal the subtle and dramatic changes in the autonomic nervous system (ANS) (Sime, W., 2003).

Muscle contraction and relaxation is measured by electromyography (EMG). Temperature change is assessed via fingertip thermometers. Skin resistance influenced by sweat is evaluated by electro dermal assessments (EDR).Cardiovascular activity is measured via heart rate, heart rhythm, and blood pressure. Respiration is analyzed by the depth and rate of breathing, and brain wave activity is measured by electroencephalography (EEG).

Regulating a range of optimal arousal in order to become a more efficient and consistent high-level performer is a difficult skill that is usually developed over time with much practice and training. Hanin's Zone of Optimal Functioning (ZOF) depicts the interaction of emotional states and optimal performance. This theory considers differences in arousal levels and emotions and their influence on ideal performance states. Some athletes thrive on higher levels of arousal for optimal performance, whereas others find this state to be counterproductive to performance (Hanin, Y.L., 2000).

Addressing the influence of emotions that pertain to athletes will assist them in identifying their zone of optimal performance. This occurs during biofeedback as the individuals visualize their psycho physiological

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response to emotions and implement self-regulation strategies to control the effects of dysfunctional emotions. Therefore in biofeedback training, the clinician assists the athlete in developing strategies to gain voluntary control over biological responses that are not normally, consciously controlled. This is referred to as self-regulation (Blumenstein, B., 1997). During this self-regulation process, the athlete learns to regulate various physiological states with instrumentation and then proceeds without the use of feedback devices. Eventually, the athlete transfers the knowledge acquired through biofeedback training into other arenas of life. Ultimately, the client is trained to perceive unhealthy biological responses during daily activities and is able to substitute healthier responses in such events (Gould, D., 2002). Research in sport psychology and biofeedback is primarily concerned with issues related to
affect, emotions, arousal and focus and their relationship to performance (Gould, D., 1994).

Arousal regulation and focus are known to be crucial aspects to quality performance. The advantage of utilizing biofeedback training as a means to prepare for competition is to facilitate cognitive and affective awareness which is likely to improve the probability of a successful performance (Edmonds, W.A., 2005). Research has shown that psychological and physiological stress, experienced by athletes during training and competition, can be regulated by biofeedback training.

To date the roles of sport psychologists is very important; about coaches, players and other related team members. This research studies about the Taekwondo, one kind of the Martial Art. Few forms of sports competition include a greater segment of mental skills than martial arts. Psychological aspects of martial arts combat are extensive before, during and even after the event. Concepts such as psychological preparation, concentration, anticipation, flow, emotional control, self-control, confidence and competitiveness are at the heart of this ancient form of combat. A discussion of the application of sport psychology to martial arts includes examining the combatants' desirable psychological dispositions that explain or predict success, and the mental skills and behavioral tendencies before, during and following competition. There is debate regarding psycho physiological techniques and performance enhancement because it is difficult to ascertain their true relationship. Do psycho physiological techniques truly result in improved athletic performance, or are the cognitive-affective responses merely a byproduct of the intervention program?

MATERIALS AND METHOD

This study involved 5 athletes (male - between 19 and 23 years old) who competed at the country level. This is a kind of stressful sport during competition. All athletes had at least two years of experience. The instruments used in gathering physiological data were a Pro Comp Infinity (the hardware) and Biograph Infinity (the software).

Biofeedback sensors were temporarily applied to the athlete's body to record data. Respiration rate per minute was measured by a strain gauge around the abdomen below the ribcage. The first an interview was conducted with each athlete to explore how they had, to date, used specific psychological skills such as stress and anxiety control, relaxation, and focus .The athletes were also asked to talk about their performance in competition from the previous season. Following the interview, physiological base line data was collected to establish the athlete's psychophysiology baseline. During each hour training session, the athlete completed 30-60 minutes of Biofeedback training .Finally each of them completed 20 hours of respiratory training. Of course the athlete received several Biofeedback sensors for temperature, EMG, HRV, EDR, EEG, that this article presents only respiratory training. The changes of physiological factors were shown by monitor which was a graphical representation. In respiration rate feedback training, respiration pattern, which is depth and frequency of breathing, is highly sensitive to changes of both arousal level and emotional factors. The rate of breathing is controlled by the partial pressure of carbon dioxide in the bloodstream and can be decreased by blowing out all the carbon dioxide from the bottom of the lungs. Doing this will lower the breathing rate to 5 to 8 breaths per minute. An ideal rate of breathing for most adults is 6 breaths per minute. Effortless diaphragmatic breathing reduces sympathetic arousal which encourages regeneration, releases tension, and increases physical and mental relaxation.

Result:

The results were the quantitative data. They were gathered during the Biofeedback training assessments and organized by individual athlete.

According to the table:

Athletes' Respiration Rate Data - Initial & Final

Initial Assessment			**Final Assessment**								
Athlete	**Baseline**	**Task**	**Recovery**	**Baseline**	**Task**	**Recovery**					
1	7	12	5.2	6	11	5.4					
2	12	13.1	10	11	12	9.5					
3	12	12	11.2	7	10	8					
4	15	12.5	14	10	10.5	12					
5	9	13	9.2	7.5	10	7					

Athlete 1: This athlete was in the ideal range for respiration rate (recovery6-8 br/min).
He improved his ability to self-regulate. In future training his goal should be to keep it.

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Athlete 2: Resting respiration rate was slightly high at 10-11 breaths per minute compared to the target criteria of 5-8 breaths per minute. It should be lowered to between 5-8 breaths per minute which will also help to increase HRV (Heart Rate Variability).
Athlete 3: Respiration rate was elevated to 11-12 breaths/minute during the rest and recovery phases. He could decrease it by respiratory training. He needs to continue his training in future.
Athlete 4: In initial, high resting respiration rate (14-15 breaths per minute). He demonstrated an improved ability to decrease sympathetic arousal (by decreasing of resting breathing rate).
Of course the ability to decrease resting respiration rate to 5-8 breathes per minute is the most important modality that needing to be trained.
Athlete 5: He demonstrated an improved ability in decreasing sympathetic arousal, indicated by a lowered resting breathing rate, too. He needs to continue breathing exercises.

Coclusions:

The purpose of this study was to explore the Biofeedback training, which trains self-awareness and self-regulation of physiological and mental-emotional states. But this article reports only respiratory training.

The athletes can enhance their sport performance because it gives them new tools for stress managing, arousal and anxiety regulation (according to the result).These findings support Schwartz and Anderasik's statements (2003). There for, after respiratory training, all athletes developed self-awareness of the Respiration Rate (one of their physiological states). Also they developed self-regulation techniques to decrease their sympathetic arousal.

The athletes became more aware of their own early signals of stress, such as respiration rate, they were able to use this signal as cues to relax or shift focus while doing tasks, He has suggested that the key learning is when the athlete starts to understand their own patterns and begins to identify and manage them while performing.

Historically, Biofeedback training has been used extensively in the treatment of health related disorders such as hypertension, tension headaches, migraine headaches, anxiety disorders, and insomnia (Collins, D., 1995), Biofeedback training has been shown to successfully improve concentration, attention and focus in a wide variety of domains. For instance, Schwartz and Andrasik (2003) state that noticeable positive outcomes using, Biofeedback training were observed in the treatment of Attention-Deficit/Hyperactivity Disorder (ADHD), anxiety disorders, mood disorders, seizures disorders, and traumatic brain injury. Lubar and Shouse (1976) demonstrated that teaching ADHD children to decrease the slow brainwave activity and increase the fast brainwave activity, using, Biofeedback training, improved their behavior. Based on the fact that, Biofeedback training has been proven to be a successful technique used for the treatment of these disorders, it becomes interesting to consider the technique within the sport domain. In the sport setting, particularly with elite athletes, Biofeedback training is highly appropriate. The measurement of the autonomic and central nervous system responses by psycho physiological assessment is especially relevant because of the psychological and physiological stressors inherent in the competitive environment (Tenenbaum, G., 2002). Furthermore, athletes are motivated to continuously evaluate their performance and thereby are accustomed to feedback. Maybe research in the field of Biofeedback training provides credible information to athletes, as well as coaches, sport psychologists and other support staff working with the athletes.

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