Biofeedback Training: Enhancing Athletic Performance

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Keywords: Wingate 5-Step Approach, periodization, biofeedback training, athletic performance

During the last three decades, mental skills training of athletes has become widely accepted as an important factor in sport and a vital component of successful performance of top athletes. Biofeedback training (BFT) is a key element/tool of a complex multifaceted treatment/training program aimed at enhancing athletic performance. The main purpose of this conceptual paper is to illustrate the successful integration of the Wingate 5-Step Approach to training programs that are based on a periodization principle. This integration is targeted at the development of both physical and mental skills to optimize and enhance the effectiveness of the mental training process. Examples derived from our experiences are illustrated and discussed.

Israeli judoka Arik Ze’evi (“AZ”) won a bronze medal in the 2004 Olympic Games, was three times European champion (2001, 2003, and 2004), and in 2008 was the World champion. One cannot dispute AZ’s long-term success in leading competitions. When asked what enabled him to maintain such a high level of athletic performance, AZ listed a number of factors, including physical and technical preparation. He pointed especially to the significant contribution of the psychological skills training he received, which emphasized the process of mental training with biofeedback tools. Indeed, on those occasions when this training was not available, AZ did not perform at his best.

During the last 30 years we have witnessed the evolution of applied sport psychology from a controversial and rather unacceptable field into its present status as a recognized foundation of mental practice (Vealey, 2007). Mental training of elite athletes is regarded as a complex and integrative process aimed at developing important and specific psychological (mental) skills using mental training techniques or strategies.

The Wingate 5-Step Approach

The W5SA is a self-regulation approach incorporating BFT that enables athletes to transfer the psycho-regulative skills performed in the sterile laboratory setting to real training conditions. This is accomplished by utilizing testing as well as various simulation materials, and is composed of five stages and self-regulation tests (Blumenstein & Bar-Eli, 2005). Self-regulation tests (SRT) are used to examine the athlete’s level of self-regulation at various points before each step in the W5SA (Blumenstein et al., 2002).

The first three steps take place in a laboratory setting. Step 1 (introduction), which is the learning step, demonstrates practical combinations of mental training techniques such as relaxation, concentration, imagery, and EMG (electromyography)/GSR (galvanic skin response) and HR (heart rate) biofeedback. This step consists of 10–15 meetings, 2–3 times a week, for 55–60 minutes each session. The central purpose of Step 2 (identification) is to...
identify and strengthen the athlete’s most efficient response modality in the biofeedback. Step 2 consists of 10–15 sessions. This designation of an optimal biofeedback modality is modified by the individual’s specific personal psychophysiologic characteristics and by the specific features of the athlete’s sport discipline. Different sports require different response modalities (Blumenstein et al., 2002). For example, in judo or wrestling, sports in which performance involves high levels of tactile and proprioceptive sensitivity and intense emotional involvement, EMG and GSR seem to be the most efficient modalities to measure (Blumenstein et al. 2002). In contrast, rifle shooting demands from the athlete postural, breathing, and muscle stability, and therefore EEG (electroencephalography) is more suitable (Landers et al., 1991). In this second step, special attention should be given to relaxation–excitation speed and level. For example, to achieve frontalis (forehead) muscle EMG relaxation within the range of 0.8–1.0 μV during 1–3 minutes, or excitation with imagery within the range of 2.4–2.8 μV during 1 minute, the athlete must be able to perform (in the laboratory setting) the required relaxation–excitation cycles quickly, accurately, and reliably. In the third step (simulation), the athlete mentally practices under natural conditions (environment) for about 15 meetings, 2–3 times a week, each lasting 50–60 minutes. Specifically, different audio/verbal stress factors and video clips are presented from competitive situations in which the athlete competed (Blumenstein & Weinstein, 2010). While watching the scenes, a mental cycle consisting of relaxation–excitation states is rehearsed. The main principle guiding the use of video clips in this step is to bring about a gradual elevation of the simulated stress. We simultaneously use BFT with a video camera in order to film the athletes’ facial expressions during Step 3 of training (i.e., the “double” BF procedure, Figure 3).

The aim of the “double-feedback” procedure is to facilitate facial self-regulation, which is crucial for enabling the athlete to better control his or her own emotional state. For example, to deceive the rival before and during a Taekwondo match, the fighter regulates facial expression using skills acquired with the help of the double feedback procedure.

Steps 4 and 5 take place under field conditions. The fourth step (transformation) includes 10–15 meetings, during which the athlete mentally prepares for a specific upcoming competition using a portable biofeedback apparatus. The main purpose of this step is to enable the athlete to enter real competitions with...
improved self-regulation ability. Here, the material learned and rehearsed by the athlete in steps 1–3 is transferred to actual training settings. In Step 5 (realization), the athlete applies the previously acquired mental techniques to actual competition. Portable BF devices are used in different competitive settings (between matches or fights, after warm-up, etc).

Integration of Mental and Physical Training

It has been reported that the majority of mental training techniques are used during competitions, though not during training (Frey, Laguna, & Ravizza, 2003). This may be related to the reality that effective mental training processes cannot stand alone, and should be integrated with and be paralleled to additional elements of athletic preparation, such as the physical, technical, and tactical elements, and also within the training periodization phases (Balaque, 2000; Blumenstein, Lidor & Tenenbaum, 2005; Carrera & Bompa, 2007).

Furthermore, Bompa (1999) postulated that sport training should be founded on periodization principles, consisting of three major phases: preparatory, competitive, and transition (see Figure 4). Each training phase is characterized by specific tasks, volume, load, and maintenance. Training periodization was founded in the former USSR during the 1950s and was established in the mid-1970s (Matveyev, 1981; Ozolin, 1970). This approach was successfully utilized in Eastern Europe and recently became popular in Western countries (e.g., Harre, 1982; Bompa, 1984). Periodization is a key factor in sport training and in annual (seasonal) planning (short-term, medium-term, and long-term). The main goal of periodization is to strengthen...
athlete’s development over many years and to enhance his or her achievement, minimizing such obstacles as injuries, overtraining, or other impediments to progress.

A mental training program that is founded on the periodization principles should be an integral part of athletic preparation. In the preparation phase, a combination of high volume of training and low-to-moderate intensity of training should prevail (Bompa, 1999). Moreover, a large number of low-intensity exercises and repetitions are given to the athlete to perform in this phase. Therefore, the mental training program includes the fundamentals of psychological techniques, such as relaxation, imagery, and BFT, so that the athlete will be better prepared for the next practice session. In the competition phase, the intensity of the performed technical elements increases and the repetitions decrease, while the total time of training decreases (Bompa, 1999). Therefore, the athlete should be prepared to use the psychological techniques that he or she has acquired during preparation phase both before and during the competition or the game. In this case, the duration of the practice of psychological techniques in the competition phase should be almost identical to the duration of the actual competition. For example, if a judo fight lasts 5 minutes, then the length of the imagery technique should also last 5 minutes. As seen in Figure 4, the W5SA was actually superimposed on Bompa’s periodization model; thus, in the preparation phase the introduction and identification steps are included, and in the competitive phase simulation, transformation, and realization are integrated. The W5SA is flexible and individually tailored to each athlete. For example, once an athlete has completed a full procedure, he or she might undergo modified and somewhat shorter W5SA steps in subsequent seasons (Blumenstein et al., 2002). It should be noted that our approach was successfully applied in practice with numerous elite athletes in various top-level events, including four Olympic Games and several European and World championships in different sports.

References


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