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# Quantum Biofeedback Therapy for Sport Performance

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**Abstract.** An advanced biofeedback technology, named Scientific Consciousness Interface Operation System (SCIO) that has proven applications in primary preventive medicine and athletic performance enhancement. There are over 25,000 of the devices in use worldwide in hospitals, medical clinics, naturopathic clinics, wellness centre, private offices, and homes. SCIO quantum biofeedback program has been implemented for Chinese Olympic Team prior to and during the Beijing Olympic Games. This program is implemented to assist coaches, trainers, and physicians to prevent athlete injuries, enhance contest preparation, accelerate training and post-contest recovery, and optimize overall athletic performances. Biofeedback has been used for sport performance enhancement, including at the Olympic level, for 40 years, because athletic performance is intimately linked with the athlete's ability to relax, recover, sleep, manage pain, and mentally and emotionally prepare for competition.

## 1. Introduction

Biofeedback practice is a raising interest in optimizing sport performance [1,2]. Advanced biofeedback technology that has proven applications in primary preventive medicine and to enhance athletic performance. Quantum biofeedback refer to "Quantum Electro-Dynamic Biofeedback, address the use of the SCIO (Scientific-Consciousness Interface Operation System). The SCIO incorporates capabilities of standard biofeedback technologies, such as: Electrocardiography (ECG), Electroencephalography (EEG), and medication testing, and yet it introduces an entirely new range of testing and treatment abilities based on edge science, particularly quantum biophysics and non-linear mathematics.

Previous research in sport performance has included relaxation training, moderating dysponesis or misplaced effort, reducing anxious cognitive processes (busy brain), resolving disruptive emotional distress or traumatic memories, enhancing physiological responsiveness, and reducing reaction times (RT) [3,4]. There is robust association between physical and mental performance in sport. In this perspective, the development of a wide range of mental powers, such as focus and concentration is duration of this complete attention in time [5]. A significant increase in research has documented the efficiency of biofeedback for children and adolescents that manifest behavioral, emotional and cognitive problem [6, 7]. In addition, biofeedback showed very good results for peak performance (in sport, music, ballet, for singers, as well as for executives in business) [8-12].

The rate of learning and final task performance is affected by the amount of training, training conditions and quality of practice [13]. Modifications in motor behavior are a result of maturation, motivation or training factors, such as improvements in speed [14]. The coordination of the central



nervous system and muscular system plays a vital role in obtaining of learned skills. SCIO re-educate motor skills through neuromuscular complex which is a crucial factor for a sport person to improve his or her performance.

## **2. Evidence-based applications of biofeedback in sport**

Margaret Dupee and co-author's report on research investigating the relationship between an individual athlete's ability to self-regulate and his or her world standing. The authors used a psychophysiological stress profile, monitoring the respiration rate, heart rate, heart rate variability, skin conductance, peripheral body temperature, and surface electromyography (SEMG; trapezius and frontals) of 15 elite athletes. The researchers assigned a numerical rating for self-regulation based on how well the athlete returned to physiological baselines after a stress trial. The self-regulation scores correlated significantly with the athlete's current world ranking in a competitive event. The better the overall self-regulation ability of the athlete, the better the world ranking [15].

Leslie Sherlin and colleagues report on a study of 16 collegiate-level golfers given a neurofeedback-based performance brain training. The athletes were randomized into two groups and received the intervention in successive semesters. Quantitative electroencephalography (QEEG) assessments and the QWIK test continuous performance test were conducted at baseline, after the fall neurofeedback training, and after the spring neurofeedback training, each time generating a neuro-performance assessment. The performance brain training integrates computer-based games and uses audio and visual feedback to reward desired brain states. Golf statistics were drawn from online performance databases maintained by both the men and women's teams. Group 1 showed significant improvements during the semester of the neurofeedback training, with increases in greens in regulation, decreases in the putting average, and decreases in the average number of three putts per round. Group 2 showed significant improvements in greens in regulation, fairways in regulation, putting average, and average of three putts per round [15].

The difference between success and failure in competitive kayak and canoe events is measured in milliseconds; RTs at the start of the event are a crucial component to optimal performance. Sommer Christie and Penny Werthner conducted a case study on a single, 26-year-old male national team 200-m canoe athlete and a RT training intervention. The researchers investigated psychophysiological patterns associated with the athlete's best and worst RTs. They conducted a baseline psychophysiological stress assessment, followed by 10 hours of biofeedback and neurofeedback training and 10 sets of 30 RT trials. Physiological data including electromyography (EMG), respiration rate, ectodermal response, peripheral body temperature, and QEEG were recorded simultaneously with RTs in the RT trials. The authors reported a number of physiological patterns associated with the athlete's best and worst reaction times [15].

## **3. Previous Investigation which used SCIO**

Vincenza Tommasi and co-researchers reported a study on a 35-year-old male competitive shooter, using tRNS, which applies low-level electric stimulation to the scalp, to modulate cortical excitability of motor areas and enhance shooting performance. The researchers applied stimulation to the P4 site (right parietal lobe), according to the EEG 10–20 systems. Previous research suggested that stimulation on the parietal lobes (P3/P4) can modulate visuospatial localization. The athlete performed 40 shots in two sessions, with sham stimulation in Session 1 and active tRNS in Session 2. The application of tRNS significantly improved the performance of the participant. Physiological patterns correlated with tRNS and improved shooting were also reported [15]. 30 basketball players (Male=16, Female=14) ranging in age from 18 to 28 years ( $21.70 \pm 2.71$  years) were recruited from Amritsar. The subjects did not receive any kind of psychological intervention previously and no known medical or psychiatric diagnosis was reported from the participants. The subjects represented a wide range of skills from university (43.3%), state (26.7%) to national (30%) standards. Ethical clearance was obtained from the Institutional Ethics Committee of Faculty of Sports Medicine and Physiotherapy,

Guru Nanak Dev University, Amritsar, India. The study was experimental in nature with a double-blind study design [16]. The participants were randomly assigned into three equal groups (N =10):

- 1) Experimental Group received Heart rate variability (HRV) biofeedback training (Male=8, Female=2)
- 2) Placebo Group was shown motivational basketball visual clips (Male=2, Female=8)
- 3) Control Group did not receive any training (Male=7, Female=3)

Response time is a measure of performance and is used to evaluate motor skills of an athlete. Variation in choice reaction time measured over time (i.e. pre, post and follow up) was statistically significant in each group along with interaction of group and time ( $F=14.93$ ,  $P<0.001$ ). The inter-group difference in choice reaction time was statistically no significant ( $F=1.80$ ,  $P=0.18$ ). However, the post-hoc analysis using Tukey's-HSD revealed statistically no significant difference between group 1 vs. 2; group 1 vs. 3 and group 2 vs. 3.

Similarly, for movement time the means and standard deviation for pre, post and follow up for the three groups is shown in table 2. Variation in movement time measured over time (i.e. pre, post and follow up) was statistically significant in each group along with interaction of group and time ( $F=57.35$ ,  $P<0.001$ ). The inter-group difference in movement time also was statistically significant ( $F=4.86$ ,  $P=0.02$ ) (Table 3). However, the post-hoc analysis using Tukey's-HSD revealed statistically significant difference between groups 1 vs. 2; whereas no significant difference was found between group 1 vs. 3; and group 2 vs. 3.

The means and standard deviation for pre, post and follow up shooting for the three groups is shown in table 2. Variation in shooting measured over time (i.e. pre, post and follow up) was statistically significant in each group along with interaction of group and time ( $F=75.72$ ,  $P<0.001$ ). The inter-group difference in shooting also was statistically significant ( $F=11.05$ ,  $P<0.001$ ). However, the post-hoc analysis using Tukey's-HSD revealed statistically significant difference between group 1 vs. 2 and group 1 vs. 3; whereas no significant difference was found between group 2 vs. 3<sup>[16]</sup>.

#### 4. Conclusions

Report of researches have demonstrated the usefulness of biofeedback devices for mind-body control, relaxation, sleep, stabilization of emotional arousal, facilitating greater physical balance and behavior modification. Biofeedback has been used for sport performance enhancement, including at the Olympic level, for over 30 years, because athletic performance is intimately linked with the athlete's ability to relax, recover, sleep, manage pain, and mentally and emotionally prepare for competition. Technologies that help athletes to accomplish these goals offer obvious advantages.

Sport physiologist describe biofeedback as an important tool in helping an athlete learn to control activation level, helping him to manage emotions and mood swings and ultimately assuring physiological readiness of the body for optimum performance. Biofeedback also may help athletes to have rhythmically stimulated the cardiovascular and respiratory systems causing reduction in response time and improving concentration.

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