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SPECIAL ISSUE

Athletes Are Different: Factors That Differentiate Biofeedback/Neurofeedback for Sport Versus Clinical Practice

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Biofeedback and neurofeedback training procedures are often different for athletes than for clinical patients. Athletes come to improve performance whereas patients come to reduce symptoms. This article outlines factors that distinguish work with athletes from work with clinical patients. The differences in training include the purpose of training, the nature of the participant in training, session design, and covert factors underlying the training. Unlike clients, athletes often do intensive transfer of learning training, between 2 and 6 hours of daily sport practice across days, weeks, and months. Although biofeedback and neurofeedback are important factors for enhancing peak performance, there are many covert and overt factors producing performance success such as motivation, intensity of training, ''A-ha'' experiences, experimental expectancy, behavioral consequences, and mastery learning. The training process with athletes is illustrated through a case example of a young tennis player who mastered control of his anger.

Biofeedback and neurofeedback training procedures are often different for athletes than for patients because the training purposes are different. Athletes come to improve performance whereas patients come to reduce symptoms. This article outlines factors that distinguish working with athletes from working with clinical patients. These factors include the purpose of the training, the nature of the participant in training, session design, and the covert factors underlying the training.

In clinical practice, most clients present because something is not working, and the therapist's role is to assist clients to help or ''fix it.'' The reward of treatment is generally feeling better, being more ''normal,'' or reducing/eliminating the symptom, and it is a within-person experience. Athletes, on the other hand, do not come to have their symptoms reduced or fixed; they come to improve their sport's performance. They want to be ''better.'' Better is defined in specific goals, and the outcomes are measurable such as ''run faster than X'' or ''shoot better than Y.'' Athletes want to go beyond normal—they want to be superb, to be atypical, to be the outlier. It is irrelevant what the athlete believes or feels. What is relevant is whether the performance is improved, which is a measureable and documented event.

Athletes often differ from typical patients. Male and female athletes resemble each other more than they resemble the sex norms of the average population on a wide variety of measures. They are motorically, psychologically, and anatomically different as their underlying brain mechanisms and structures are different. At this time, it is unknown whether these differences are due to genetics, early learning, or extensive practice. Most likely they are the result of an ongoing interaction of these three variables.

Decades ago, while using less sophisticated equipment, we found that volleyball players (Wilson, Ainsworth, & Bird, 1985) and track and field athletes (Wilson & Hamilton, 1983) who performed well under the stress of competition had different physiological and electroencephalogram (EEG) patterns than teammates who performed less well. Similar findings have recently been reported by Babiloni et al. (2010), who found that quantitative EEG (QEEG) patterns were different in karate athletes than in normative populations. These cortical patterns also differed at the various levels of karate skills (elite vs. amateur athletes). The main QEEG differences were the frequencies

of the eyes-closed resting state EEG rhythms in elite karate athletes as compared with nonathletes and amateur karate athletes. Elite athletes had more frontal preponderance of delta and theta, whereas alpha rhythms were higher in amplitude in the occipital and parietal regions. The researchers found similar results in a control study with elite rhythmic gymnasts. Overall, elite athletes not only have increased precision in execution but also superior performance in perception, anticipation, and decision making. These advantages were traced to changes in underlying structural and physiological processes (Yarrow, Brown, & Krakauer, 2009).

The focus and purpose of the biofeedback and neurofeedback training sessions is another major factor that distinguishes the training of athletes from clinical work with patients; this includes different session goals and divergent locations of practice.

The focus of training in sport psychology is to improve performance. The training will include problem solving to explore the differences between how athletes feel and behave when they perform well and their behavior during times of diminished performance. The focus is not on identifying the causes of the dysfunctional state but on facilitating optimal performance. For example, if an athlete gets nervous and tightens at the start gate, biofeedback/neurofeedback is used to identify this individual process, and the athlete is taught how to master the state for best performance. It focuses on mastery training and not on why the person became anxious during competition.

Second, although the identification of the correct behavior is often initiated in the office, most of the ''correct'' practice is done during the actual sport practice and competition. The athletes are taught to be aware and understand and control their different mind-body states so that they can recognize the less successful state and substitute the more successful state. The new awareness/control skills become a part of their routine, which is integrated into their normal 2 to 6 hours of daily sport practice across days, weeks, and months. The intensive long-term training probably induces significant brain changes. The changes are not the result of office training but the intensive hours of daily practice.

This intensity of skill training is typical in sports, although at times, brief therapy interventions can be very appropriate. For example, Hanin, Korjus, Jouste, and Baxter (2002) reported cases in which one training session appeared sufficient for Olympic-level athletes. These single sessions may be successful as the nature of the problem is very specific. For example, in work with a world-class archer, the archer was able to state, ''In stressful situations, I sometimes have trouble deciding when to put the bow down to avoid a misfire.'' It took one day on the range using EEG monitoring to discover that the indecision occurred when an excess of high Beta-range cortical activity was present at Cz. This high Beta elevation is a maladaptive pattern of rumination and anxious vigilance, which we call ''busy brain.'' The athlete improved immediately as he was able to anchor the difference between the busy brain state and the quiet state. Unfortunately, this learned state did not hold up under the stress of his first Olympics. Later, after more practice and experience, he became better able to control his attentive state in highly stressful situations and again won the world championship.

Biofeedback training may be only a small overt component that contributes to the athlete's success. More likely, the improvement is due to a constellation of factors because the training procedures often contain many covert factors. The typical covert factors can be found in any therapeutic session but may operate even more powerfully within a sport session. Such factors include the following:

1. The athlete is highly motivated to succeed and will do what is requested as there are few secondary gains in failure in sport.
2. The feedback display triggers an ''A-ha effect'' (Wilson, Peper, & Gibney, 2004). Seeing the biological changes on the screen is extremely effective as athletes spend most of their lives looking for and believing measures that show changes toward success. The ability to control biofeedback and neurofeedback measures reinforces a sense of personal control, which may be more powerful with athletes than patients. The athletes have a history of outcome experience as to what happens when they properly control their behavior (swing this way and the ball goes for a hit).
3. Incorrect behavior can be explained in performance or learning terms (not personal terms) and reframed as a challenge to learn new skills. By expressing ''errors'' as incorrect learning, rather than failure, the athlete is encouraged to learn new skills.
4. The experimenter effect (Harris & Rosenthal, 1985) may also be more powerful with athletes as it includes not only the expectations of the clinician affecting the athlete but also the reactions and expectations of the athlete affecting the clinician (Jussim, Robustelli, & Cain, 2009). In sports, unlike clinical practice, the expectations and outcomes are public. Usually, the athlete has either spoken with or knows of others who have been assisted by a sport clinician. Both the athlete and the clinician have a vested interest in the other to do well.

5. Behavioral stillness often occurs when practicing biofeedback and neurofeedback; this is likely similar to mindfulness or flow or quiet mind or ideal performance zone. Research on sport performances suggests that this stillness training alone may beneficially affect sport (Mulholland, 1995; Hatfield, Haufler, & Spalding, 2006).

Case Example: An Integrated One-Session Intervention by Vietta Wilson

In this case study, the covert factors serving to support improvement will be identified in parenthetical comments.

Earl, a young tennis player, had timeouts imposed and was even suspended from practice for anger issues. He had lost points and games because of lack of emotional control in tournaments. Behavioral controls by coaches and parents did not work. He initiated the biofeedback visit as he wanted to do well in the upcoming provincial tournament (high motivation). He had seen a teammate and his brother improve after working with me (high expectancy).

In the opening interview, I asked if he could be as good as his older brother Vince, who is in the top five nationally. He mumbled something about ''with a lot of work I might become good.'' I shocked him with a loud NO! As he stared at me, I explained that with his skills—and if he wanted to work hard—he would be even better. This was not only my opinion but the head coach's opinion as well (challenge, but based on trusted information). When I asked him to explain his anger problems, he said that he ''gets frustrated, and before he knows it he is furious and out of control.'' He was actually hanging his head when he explained this. I drew him a picture of a slide and asked if he had ever been on a steep water slide where he could not stop. His answer was ''yes.'' ''Well,'' I explained, ''when you are a young adult and have a highly responsive nervous system, it is the same way with frustration. If you don't stop it before it gets out of control, you are on your way down the anger slide.'' He needed to accept this and learn to stop himself before he got on the slide (reframing problem from being abnormal to something that has to be avoided by learning skills).

I then asked Earl if he truly wanted to accept the responsibility for changing (locating responsibility for change). I suggested that if he said ''yes,'' then we would begin to learn the skills. But if he failed to do the agreed upon steps in practice and during the tournament that weekend, I would not work with him (consequences).

We began with an on/off training model with heart rate variability and respiratory biofeedback training, and Earl quickly was able to show a respiration sinus arrhythmia (RSA) pattern, with smooth parallel line graphs of respiration and heart rate change (skills by which he could control success). ''On training'' meant he observed the pacer for guidance and the feedback from the parallel lines. ''Off training'' is when he looked away and continued with maintaining his RSA.

We moved to training Earl's EEG activity at Cz (the central location on the cortex), and Earl learned to produce a calm and focused state of consciousness, characterized by an enhanced Alpha range cortical activity and squashed or suppressed Theta activity. We then moved to training Earl to enter ''the zone,'' that is, an enhanced sensorimotor rhythm in the EEG, with lessened mental chatter and a reduction of Beta-range EEG activity from 19 to 34 Hertz.

Earl experienced initial success and then was shaped to more difficult thresholds with comments about these being ''the professional level.'' He was not expected to be as skilled, but he was expected to show improvements (a process that parallels competition expectations). With each of these biofeedback and neurofeedback practices, Earl mastered a skill that would be included in his actual on-court routine (transfer of learning).

For self-control, Earl mastered a brief self-regulation skill in which he slowed his breathing, relaxed his muscles, enhanced letting go, and then focused on what he needed to do right then. We call this ''Ahhasome'' (Wilson & Cummings, 1998). This was followed by a self-talk exercise of stopping negative thoughts and replacing them with cue words to stay or get back into control.

Seeing the effects in the biofeedback and neurofeedback when he did the ''Ahhasome'' exercise or moved from negative to no self-talk created a belief for Earl in the value of his home training practices (increased motivation). He also had a pre-bedtime routine in which he visualized himself getting upset and then getting back in control again (imagery). He also used a heart rate variability biofeedback monitor to keep his breathing regular and his mind calm. We also developed a management routine for Earl, in case he started to lose it emotionally. His management routine allowed him to get mad, but once angry, Earl has to go to the back of the court, do his ''Ahhasome'' exercise, slow down, and get back together emotionally before he faces his opponent with his game face on, or he has to take a bathroom break.

This last point is very important because clinicians have to prepare athletes for how to perform the sport skill(s) when they are not in a perfect state. For example, what strategies and skills do you switch to that will give you a better chance of winning the point when you are upset? The training strategy is a behavioral approach, which includes writing out homework as well as signing a statement agreeing to do the homework 80% of the time

in practice, home, and competition. A copy of this agreement also goes to the coach. The boundaries of behavior are established by the agreement.

The agreement had consequences for Earl. Failure to follow the agreement meant that he would not be seen again. Success meant we would continue to work on his becoming even better for nationals. The initial session lasted 1½ hours. Here are the results in the words of Earl and his father, after the provincial trials.

Earl: Yesterday. I was playing really well mentally and physically. I was doing my ritual after every point. I won the first set 6-1. … Every rally was about 10 balls, and I just stayed in the point and didn't rush it. The second set I lost 6-4 because I think I started to relax after the first set. Before the third set started I took a washroom break like Sue told me to do when I'm getting mad. In the third set I went down 3-0 and started getting really mad. … I hit my racket on the ground a few times. But when I was down I was thinking of what Sue said to do, and [was able to] slow things down and relax my face and shoulders. This really helped me to get back into the match.

Earl's father: I am so happy to tell you that I watched the match last Saturday, and I see the progress in … significantly. At least he knew what to do to get out when he was frustrated and he intentionally managed his anger. Unlike the previous times when he just threw the racket, whining … and just hit without any control and let the opponent to dictate and win the match. This time even he was two serve games down in the third set, but he tried to manage to get back in the game and won eventually.

At 3-month follow-up, Earl has not reverted to his past disruptive behavior in either practice or competition. However, his non–English-speaking mother worries about his frequent bathroom breaks. Most likely, the reasons for his success were that (a) he was ready to change (luck and timing), (b) the challenge that he could be better than his big brother resulted in a changed belief system (an ''A-ha'' effect), and (c) a concrete experience with the on/off training using biofeedback and neurofeedback and behavioral strategies, which showed him that he could control his thoughts and behavior. In addition, Earl accepted that he was responsible for gaining this control.

Discussion

In summary, athletes as compared with patients are often more quickly successful in biofeedback and neurofeedback training because they are highly motivated, transfer the skills to sport, and are willing to do the home practice if they see it as meaningful. However, the successful outcome of biofeedback and neurofeedback training depends on multiple overt and covert factors. The use of brief learning models within the session facilitates the effectiveness of the session and encourages the athlete to assume responsibility for outcomes.

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