Biofeedback
Volume 43, Issue 4, pp. 168–172
DOI: 10.5298/1081-5937-43.4.03

SPECIAL ISSUE

Seeing is Believing: Biofeedback as a Tool to Enhance Motivation for Cognitive Therapy

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Keywords: imagery rehearsal, biofeedback, surface EMG, cognitive behavior therapy

Cognitive behavior therapy (CBT) as applied by behavioral scientists includes strategies for changing negative cognitions that contribute to depression and anxiety. Biofeedback is a useful strategy to demonstrate to clients the mind (cognitive, psychological) to body (physiological) interaction. For example, a cognitive, psychological reaction to a stimuli results in a physiological effects as illustrated by changes in skin conductance or muscle tension. A case example is used to demonstrate an anticipatory psychophysiological response resulting in covert activity of the forearm as a client simply imagines playing the piano.

My arm did not move and yet the surface EMG from my forearm increased when I mentally rehearsed playing the piano. I did not notice anything. It really made me aware how my thoughts affect my body.

—25-year-old female psychologist

Cognitive behavior therapy (CBT) as applied by behavioral scientists includes strategies for changing negative cognitions that contribute to depression and anxiety (A. T. Beck & Alford, 2009; Clark & Beck, 2011). Broadly, the concept that thoughts affect the body has been described by many researchers. For example, Whatmore and Kohli (1975) used the term "representing efforts," which are the efforts we bring forth within our self during thinking, remembering, anticipating, daydreaming, and worrying. Similarly, Green, Green, and Walters (1970, 1999) described a process of thoughts influencing human physiological reactions as the "psycho-physiological principle," where "every change in the physiological state is accompanied by an appropriate change in the mental-emotional state, conscious or unconscious, and conversely, every change in the mental-emotional state, conscious or unconscious, is accompanied by an appropriate change in the physiological state" (1970, p. 3).

Challenges to CBT include how to motivate clients to observe and transform their thoughts, since they are often unaware that thoughts or emotions affect the body (J. S. Beck, 2005). Therapists can demonstrate this mind/body interaction with physiological monitoring to change their clients' illness beliefs and demonstrate how ruminating thought processes—continually imagining and/or thinking about a difficult situation—may affect both mental and physical health (Peper, Shumay, & Moss, 2012). When clients see their body's physiological responses triggered by thoughts and emotions, they gain a perspective that allows them to know that their own cognitions affect them—the evidence is objectively indisputable.

More importantly, operant conditioning techniques can be applied to provide feedback that demonstrates ways clients can affect and control their own physiological reactions to their negative cognitions (Schwartz & Andrasik, 2003). A number of studies have investigated the physiological stress responses produced by script-driven traumatic imagery or repeated fear-induced stimulus among patients with posttraumatic stress disorder; the intrusive thoughts frequently induce elevated cortisol and catecholamine responses (Hoge et al., 2012; Ironson et al., 2014; Thompson et al., 2014).

Learning to control bodily reactions to negative cognitions is a potent motivator for clients. For example, Moss (1998) stated,

The excitement of enhancing personal control and self-direction is never entirely lost even in the most mundane clinical procedures. Clinicians frequently report that patient's utilizing biofeedback instruments have repeated "Eureka" experiences: "You mean that when I change my thoughts, my heart slows down and my heart rate and breathing come into balance," or "I can do it! I can warm my own hands with

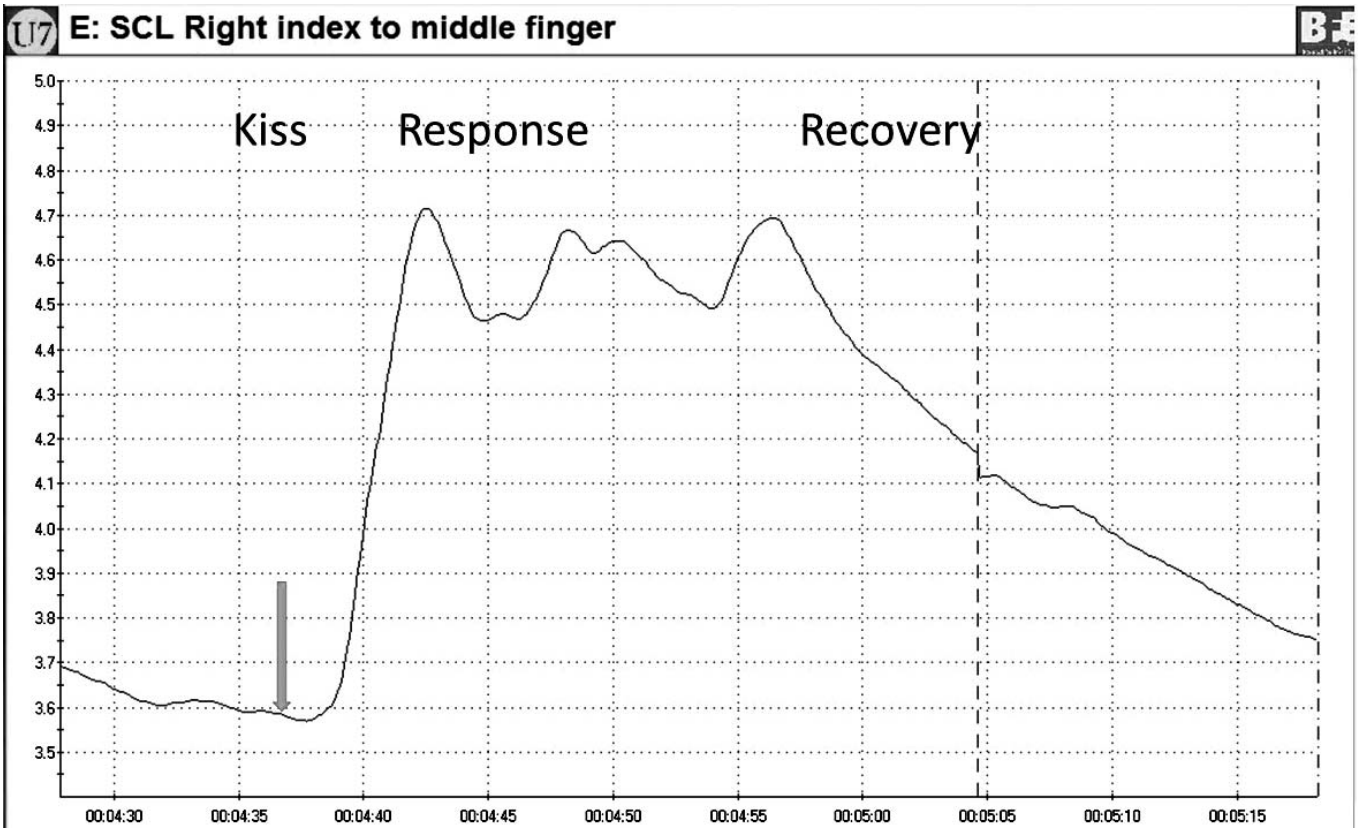

Figure 1. The effect on SC level of hearing the instruction that someone will give her a kiss.

my own mind. And I don't ever have to have headaches again." (1998, p. 157)

This mind/body connection can be demonstrated when recording most physiological signals. It can be done as a demonstration in front of a group in which only one person is attached to the equipment. All the group members can see the person's physiological response to a systematic set of prompts. For example, when a volunteer had her skin conductance (SC) level monitored, and another person was asked in the group to give the volunteer a kiss, in almost all cases there was an increase in SC response just after the instruction was given to kiss the volunteer, whether or not the volunteer actually kisses the volunteer. The volunteer was responding to the potential that a kiss might (or might not) occur, as shown in Figure 1.

For educators and psychotherapists, a major use of biofeedback and operant training approaches is to demonstrate a connection between physiological reactions and positive mental rehearsal and visualization or, conversely, negative cognitions and ruminations. The process of linking physiological reactions with thoughts can be effectively demonstrated with surface electromyography (surface EMG or SEMG) recorded from muscles that become activated when the person ruminates or mentally rehearses a task as illustrated in the following example.

Case Narrative

The participant was a 25-year-old female psychologist who also was an accomplished pianist who had practiced for more than 16 years. Muscle activity was recorded from her right forearm extensor muscle and displayed on a large screen that other group participants could observe. The software (ProComp Infiniti software version 6.0, Thought Technology, Ltd., Montreal, Quebec, Canada) simultaneously video recorded with the computer webcam and the physiological data so that both could be displayed.[1] After setting the channels for recording, the signal was checked for accuracy with a behavioral test (asking her to move her fingers). She was asked to relax, then to imagine playing a musical piece, then relax, and again imagine playing a musical piece and then relax. After saving the data, the session can be replayed for further learning. The

[1] For those using the ProComp Infiniti software version 6.0, the channel set and screen used for this recording can be downloaded for use from http://thoughttechnology.com/index.php/software-updates

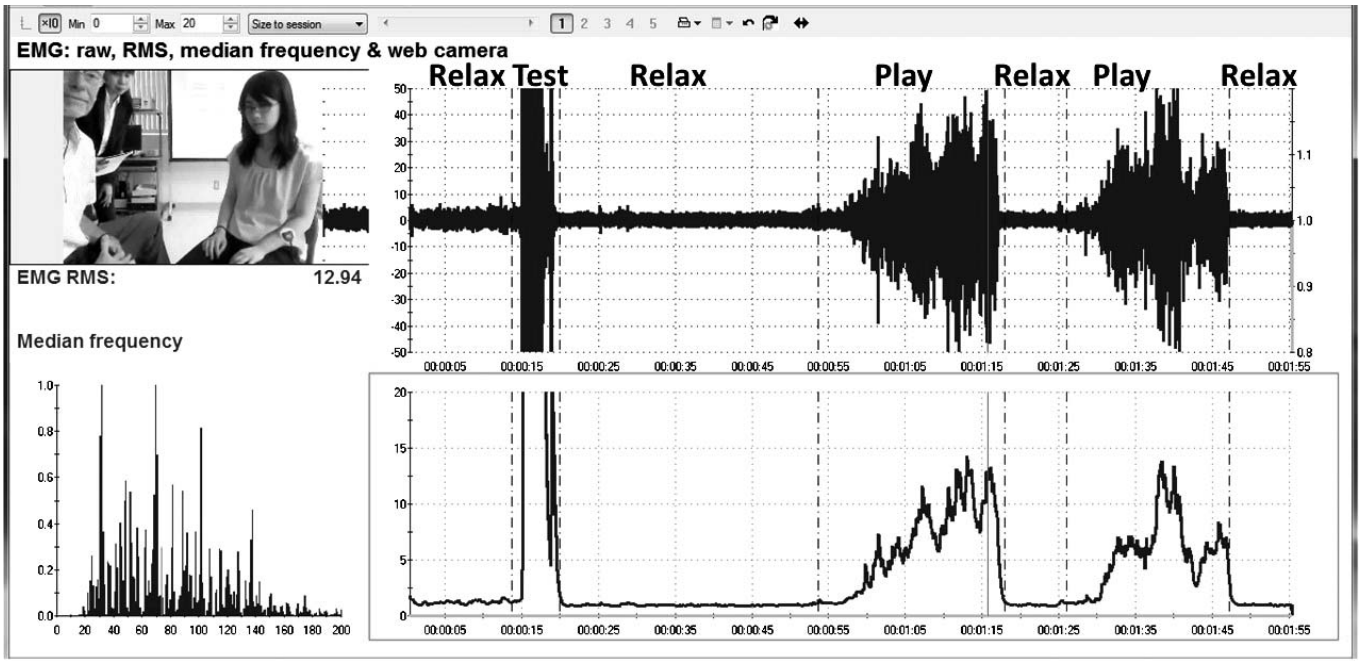

Figure 2. The covert SEMG increase in forearm SEMG as the participant imagined playing the piano.

person can actually see her own physiological recording and herself.

Results

Each time she imagined playing the piano, the forearm extensors' muscle tension increased, even though there was no overt observation of finger and forearm movement, as shown in Figure 2. After the recording, the session was replayed so she could see herself and her movements on the screen simultaneously with the SEMG signal. She reported being totally unaware that she had tightened the forearm muscles and was totally surprised when she saw the recording of the SEMG activity while her forearm appeared to stay in a relaxed position.

Discussion

Using physiological monitoring techniques provides an opportunity to show clients their physical reactions to positive or negative cognitive processes. For example, in this case narrative monitoring the arm muscle tension using SEMG provided a demonstration of how mental rehearsal increased the participant's forearm SEMG when she imagined and subjectively experienced playing the piano. The somatic body involvement, and thus the increased SEMG levels, are greater if the person experiences the mental rehearsal as a felt experience versus an external visualization.

Even though the SEMG increases during the rehearsal, most people are unaware that their body has reacted. Mental rehearsal of piano playing activates the muscle patterns, just as worries, ruminations, or recalling negative memories—especially when they are felt as a somatic experience versus being an observer—activate physiological body responses. Each time the person thinks and experiences the negative memory or state, it activates the same somatic response as occurred during the actual experience, just as playing the piano activated the muscles of the forearm. Thus, clients need to become aware of the cognitive trigger and also to learn new strategies to change their cognitions so that they do not trigger the corresponding physiological reactions. The extent of change in cognitions or physiological reactions will depend on the individual client; however, operant conditioning and biofeedback procedures facilitate faster and more comprehensive awareness of links between thoughts and bodily reactions. For example, the more a person has practiced a skill, especially when they experience the imagery as if it is real, the more likely will the SEMG show activation.

The visual demonstration of sensory motor behavior linked to rehearsal (Suinn, 1984) facilitates change. Once awareness has been elicited, it can be used as a motivator because the clients know what is possible in terms of change. Similarly, by interrupting negative ruminations and behavior patterns and then rehearsing and visualizing new behavior patterns, the client learns that the practice of

new and healthy patterns is possible and desirable. For example, previous studies also found beneficial effects in reducing stress and the associated symptoms by using guided imagery in stress management program for pregnant women (Jallo, Cozens, Smith, & Simpson, 2013; Jallo, Salyer, Ruiz, & French, 2015).

We strongly recommend that cognitive behavioral therapy training programs for educators, psychologists, and other therapeutic practitioners include this procedure for demonstrating the links between cognitions and physiological reactions.

After such a demonstration, the therapist may point out that what happens in the office setting is likely the identical process that occurs when a person worries, has negative cognitions, continuously reviews personal failures, or makes judgmental statements such as "I should not have done _____." When individuals think a negative statement such as "I should not have _____," they are mentally rehearsing what they should not do and are unintentionally strengthening the negative behavior even more. Instead, whenever the person becomes aware of the beginning of the negative cognitions, the person can learn to stop and change these negative cognitions to positive cognitions. In this way they can rehearse what they would want to do instead of what they do not want to do. That is, they are rehearsing what they want to achieve (Peper, Gibney, & Holt, 2002). The more you rehearse what you want to achieve, the more likely it is to occur. This strategy is useful to change clients' illness beliefs and motivate them to transform their cognitions from what they do not want to what they want to do. In addition, it offers CBT documented evidence—the biofeedback recording—provides the actual data that is necessary for evidence-based health and medicine.

Between stimulus and response there is a space. In that space is our power to choose our response. In our response lies our growth and our freedom.

—Victor E. Frankl

Acknowledgment

The authors thank Dr. Donald Moss for his superb editorial contributions.

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