Introduction of Biofeedback

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What is Biofeedback?
Definition of Biofeedback

- A group of **therapeutic procedures** that
- uses **electronic or electromechanical instruments**
- to accurately **measure, process, and feedback**, to persons and their therapists,
- information with **educational and reinforcing properties**
- about their **neuromuscular and autonomic activity**, both normal and abnormal,
Definition of Biofeedback

• in the form of analog or binary, auditory, and/or visual feedback signals.
• Best achieved with a competent biofeedback professional,
• the objectives are to help persons develop greater awareness of, confidence in, and increase in voluntary control over their physiological processes that are otherwise outside awareness and/or under less voluntary control,
Definition of Biofeedback

• by first controlling the external signal,
• and then by using cognitions, sensations, or other cues to prevent, stop, or reduce symptoms.
Models Used in the Biofeedback Literature

• Physiological changes result in symptom changes
• Cognitive changes
• Placebo/nonspecific effects
• Feedforward processes
• Bandura’s self-efficacy
Models Used in the Biofeedback Literature

• The patient education model
• The R. Rosenthal interpersonal expectancy model
• The Omer and London model
• The aptitude X treatment interaction (ATI) model of treatment effectiveness
Instrumental Conditioning of Autonomic Nervous System Responses

• Biofeedback as a learning theory.
• Principles of operant learning: schedules of reinforcement, shaping, discrimination, generalization, extinction, & habituation.
• The role of mental processes in learning.
Psychophysiology

- As a form of applied psychophysiology, clinical biofeedback helps individuals change their behaviors with feedback from their physiology.
Behavioral Therapy & Behavioral Medicine

• The roots of behavioral therapy involve the notion that one learns maladaptive behaviors and thus, one can unlearn them.

• Behavioral therapy applies the principles of operant and respondent conditioning, as well as cognitive learning to change behaviors.

• Behavioral medicine focuses on applications of learning theories to medical disorders and other health related topics.
Stress Research & Relaxation Therapies

• *Fight or Flight response*

• Selye’s physiological stress response: alarm, resistance & exhaustion.

• Progressive muscle relaxation training

• Guided Imagery

• Autogenic training
Why Biofeedback?

• The biobehavioral therapies, including biofeedback, are used
  ➢ as **adjuncts** to pharmacological treatments,
  ➢ as **part** of lifestyle change, or
  ➢ as a **stand-alone** therapy.
Application of Biofeedback

• Phobic & Anxiety Disorders
• Mood Disorder
• Insomnia
• Migraine
• Essential Hypertension
• Tension Headache
• Chronic Pain
• Chronic Fatigue Syndrome
• Temporomandibular Joint Syndrome (TMJ)
• Muscle Tension
• Urinary Incontinence
What Biofeedback Instruments Are Supposed to Do

• To **monitor** a physiological process.
• To **measure** what is monitored.
• To **present** what is monitored or measured as meaningful information.
Skin Temperature

- A correlate of peripheral vasoconstriction.
- An indirect measure of sympathetic outflow.
EMG (Electromyography)

- Measures muscle activity by detaching electrical activity occurring with certain muscles.
- An electrical correlate of muscle contraction.
Skin Conductance

- A correlate of sweat gland activity.
  - Galvanic skin response (GSR)
  - Electrodermal activity (EDA): electrodermal level (EDL), electrodermal response (EDR)
  - Skin conductance activity (SCA): skin conductance level (SCL), skin conductance response (SCR)
- An indirect measure of sympathetic outflow.
Heart Rate

• Measured in beats per minute, typically by a heart rate sensor that monitors the light level transmitted through the vascular tissue of the fingertip and the variations in light intensities corresponding to variations in blood volume.
Respiration

• Measured in breaths per minute, typically be a strain gauge worn around the chest or the abdomen.
Biofeedback Modalities for Treatment of Hypertension

- Thermal biofeedback
- Direct BP biofeedback
- EMG-frontalis biofeedback
- Electrodermal feedback
- Respiratory sinus arrhythmia (RSA)
Thermal Biofeedback

- **Skin Temperature Gauges** show changes in the amount of heat given off by the skin, a measurement that indicates any change in blood flow.
Thermal Biofeedback---Hand Warming

• The main goal of hand-warming is to assist in measuring our level of stress through skin temperature, and thereby allow us to change our stress level to meet the circumstances.
Thermal Biofeedback

- The goal in temperature training is to turn off the SNS
- Work best when the training lasts for about 15 minutes
- Accompany autogenic training and/or imagery
- Goal of handwarming: $\geq 90 \, ^\circ F$
- Maximum vasodilation: 96 °F
Real-Time BP Biofeedback
EMG-frontalis Biofeedback

Raw EMG (simulated)

Rectified EMG

Integrated EMG
EMG-frontalis Biofeedback

• The EMG measures the amount of electrical discharge in the muscle fibers and therefore it quantifies muscle contraction and relaxation. This electrical discharge is translated into auditory and visual displays and the person can begin to notice and bring about changes in muscle tension which he/she was previously unable to do.
EMG-frontalis Biofeedback

• **EMG and Biofeedback:** The electromyograph (sEMG) allows readings to be taken via 3 surface sensors placed on the skin over appropriate muscles.
EMG Training for Stress Management

• Frontal EMG training for stress management: train to reduce muscle activity for general muscle relaxation
Electrodermal Feedback
Electrodermal Feedback

• **GSR in Biofeedback:** The galvanic skin response (GSR) feedback instrument measures skin conductivity from the fingers and/or palms. The GSR is highly sensitive to emotions in some people.
Electrodermal Feedback

- **Galvanic Skin Response Sensors** (GSRs) use the amount of sweat you produce under stress to measure the conductivity of your skin. They are often used to reduce anxiety.
Respiratory Sinus Arrhythmia (RSA)