Video Article

Psychophysiological Stress Assessment Using Biofeedback

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Abstract

In the last half century, research in biofeedback has shown the extent to which the human mind can influence the functioning of the autonomic nervous system, previously thought to be outside of conscious control. By letting people observe signals from their own bodies, biofeedback enables them to develop greater awareness of their physiological and psychological reactions, such as stress, and to learn to modify these reactions. Biofeedback practitioners can facilitate this process by assessing people s reactions to mildly stressful events and formulating a biofeedback-based treatment plan. During stress assessment the practitioner first records a baseline for physiological readings, and then presents the client with several mild stressors, such as a cognitive, physical and emotional stressor. Variety of stressors is presented in order to determine a person's stimulus-response specificity, or differences in each person's reaction to qualitatively different stimuli. This video will demonstrate the process of psychophysiological stress assessment using biofeedback and present general guidelines for treatment planning.

Video Link

The video component of this article can be found at http://www.jove.com/video/1443/

Protocol

Part 1: Setting up and preparing the skin

1. Set up the following sensors breathing belt, EMG, ECG, skin conductance, temperature, ground;
2. Prepare the skin by gently rubbing with an alcohol wipe in the following locations: forehead above the eyes for EMG, inside of both wrists for ECG, back of left hand for the ground (location of ground electrode may vary depending on equipment used);
3. Attach sensors to the skin in the following locations: breathing belt around the waist, EMG on the forehead above each eye, ECG on the inside of each wrist, skin conductance on middle finger of left hand, thermometer on the pointer of left hand, ground on the back of left hand;
4. Select session for Breathing+HRV;
5. Make sure that impendence is acceptable for all sensors and that the sensors are responsive to client's movement and producing reasonable readings.

Part 2: Recording

1. Explain the procedure to the client.
2. **(min 0-2)** Instruct the client to sit quietly with eyes open. Record a two-minute baseline.
3. **(min 2-4)** At the end of two minutes, begin a two-minute cognitive stressor – arithmetic problems gradually increasing in difficulty to be solved without use of pen & paper or calculator (if arithmetic is particularly difficult for the client, ask them to repeatedly subtract seven starting from 100, i.e., "serial sevens"). Give the following instructions to the client: "In the next 2 minutes, I will be asking you to solve some math problems. Please work as quickly as you can and tell me the answer". Do not provide feedback as to whether the client's answer is correct or incorrect and provide minimal encouragement (eg., "just do the best you can") so as not to eliminate the mild stress inducing properties of this exercise.
4. **(min 4-6)** Let the client know that this part of the assessment is over and ask him/her to sit quietly with eyes open for 2 minutes.
5. **(min 6-8)** Begin physical stressor: turn on loud noxious noise (babies crying, car crashes, etc.) and ask the client to listen to the sounds without tuning out.
6. **(min 8-10)** Turn off noise, and ask the client to sit quietly with eyes open for 2 minutes.
7. **(min 10-12)** Begin emotional stressor: ask the client to talk about a stressful incident that they remember well, include the details of the event, what they were thinking and feeling. Provide minimal empathic response so as not to mitigate the stress response.
8. **(min 12-14)** Interrupt the client's story, even if he/she has not finished, and instruct the client to sit quietly with eyes open.
9. Stop recording, save the data, and let the client know that the assessment is done.

Part 3: Debriefing and treatment planning

1. Ask the client about their experience during the assessment.

   Which parts were particularly stressful and why?

   Did he/she feel any physiological changes happening?
2. Review data according to the criteria described in appendix I.
3. Chose physiological parameters that need to be addressed based on above analysis.

   If sensor reading at baseline is higher or lower than normal, the treatment goal is to help the client bring that physiological parameter to normal in a non-stressful environment.

   If sensor reading during the stressor is higher or lower than normal, the treatment goal is to help the client identify stressors and be able to maintain normal level of physiological functioning under stress.

   If sensor reading during down time indicates lack of recovery, the treatment goal is to help the client bring that physiological parameter to normal level quickly following a stressor.

   Any or all of these goals may be included in the treatment plan.

Appendix I

Stress assessment interpretation guidelines

(all “bold” answers indicate areas to be addressed)

EMG (normal reading <3 microvolts)		
1. Is EMG elevated at baseline?	**yes** _	no _
2. Is EMG elevated past the baseline at any of the 3 stressors?	**yes** _	no _
3. Is there recovery of EMG to baseline level during rest periods?	yes _	**no** _
Heart rate (normal range 60-80 beats per minute)		
1. Is heart rate elevated at baseline?	**yes** _	no _
2. Is heart rate elevated past the baseline at any of the 3 stressors?	**yes** _	no _
3. Is there recovery of heart rate to baseline level during rest periods?	yes _	**no** _
Breathing rate (normal rate <12 breaths per minute)		
1. Is breathing rate elevated at baseline?	**yes** _	no _
2. Is breathing rate elevated past the baseline for any stressor?	**yes** _	no _
3. Is there recovery of breathing rate to baseline during rest periods?	yes _	**no** _
Skin conductance		
1. Is skin conductance elevated at baseline?	**yes** _	no _
2. Is skin conductance elevated past the baseline for any stressor?	**yes** _	no _
3. Is there recovery of skin conductance to baseline during rest periods?	yes _	**no** _
Finger temperature (normal reading >90F)		
1. Is finger temperature low at baseline?	**yes** _	no _
2. Does finger temperature decrease past the baseline for any stressor?	**yes** _	no _
3. Is there recovery of finger temperature to baseline during rest periods?	yes _	**no** _

Heart rate variability (norms vary by age)		
1. Is heart rate variability low at baseline?	**yes _**	no _
2. Does heart rate variability decrease past the baseline for any stressor?	**yes _**	no _
3. Is there recovery of heart rate variability during rest periods?	yes _	**no _**

Appendix I

Stress assessment interpretation:

EMG (normal reading <3 microvolts)		
1. Is EMG elevated at baseline?	**yes _**	no _
2. Is EMG elevated past the baseline at any of the 3 stressors?	**yes _**	no _
3. Is there recovery of EMG to baseline level during rest periods?	**yes _**	no _
Heart rate (normal range 60-80 beats per minute)		
1. Is heart rate elevated at baseline?	**yes _**	no _
2. Is heart rate elevated past the baseline at any of the 3 stressors?	**yes _**	no _
3. Is there recovery of heart rate to baseline level during rest periods?	**yes _**	no _
Breathing rate (normal rate <12 breaths per minute)		
1. Is breathing rate elevated at baseline?	**yes _**	no _
2. Is breathing rate elevated past the baseline for any stressor?	**yes _**	no _
3. Is there recovery of breathing rate to baseline during rest periods?	**yes _**	no _
Skin conductance (normal reading <5 micro ohms)		
1. Is skin conductance elevated at baseline?	**yes _**	no _
2. Is skin conductance elevated past the baseline for any stressor?	**yes _**	no _
3. Is there recovery of skin conductance to baseline during rest periods?	**yes _**	no _
Finger temperature (normal reading >90F)		
1. Is finger temperature low at baseline?	**yes _**	no _
2. Does finger temperature decrease past the baseline for any stressor?	**yes _**	no _
3. Is there recovery of finger temperature to baseline during rest periods?	**yes _**	no _
Heart rate variability (norms vary by age)		
1. Is heart rate variability low at baseline?	**yes _**	no _
2. Does heart rate variability decrease past the baseline for any stressor?	**yes _**	no _
3. Is there recovery of heart rate variability during rest periods?	**yes _**	no _

Treatment planning:

If a reading is higher or lower than normal at baseline, goal of treatment is to help client bring that physiological parameter to normal in all circumstances

If a reading is higher or lower than normal during the stressor, goal of treatment is to help client identify stressors and be able to maintain normal level of physiological functioning under stress

If a reading indicates lack of recovery during down time, goal of treatment is to help client bring that physiological parameter to normal level quickly following a stressor.

Discussion

Completed psychophysiological in the appendi stress assessment provides a biofeedback practitioner with information necessary for formulating a treatment plan. This assessment provides information about both the individual's response stereotypy, or uniformity of certain physiological responses to all stressors, and stimulus-response specificity, or individual's unique physiological responses to different kinds of stressors. With this information, the client is then able to learn to predict what kind of physiological response to expect in which situation and be able to modify his/her response accordingly.

Following the assessment, it is important for the practitioner to inquire about the client's subjective experience of the stressors in order to catch any mismatch between client's subjective experience and physiological readings. Such mismatch would then need to be addressed during treatment.

It is also important to keep in mind that effects of the stressor presented first may impact client's response to subsequent stressors. One possible solution to this problem is to present stressors to the same client in different order on several occasions. However, this is time consuming and may not be feasible in a clinical, non-research, setting.

The protocol presented here is a general guideline, with many possible modifications depending on each client's individual needs and on the equipment available to the practitioner. Placement of EMG sensors may vary depending on the presenting problem (eg., massester and/or sternocleidomastoid muscle for TMJD, upper trapezius and/or frontalis muscle for tension headaches). Particular stressors presented may vary according to what the client is likely to encounter in real life. With different equipment used, particular settings/programs used would vary accordingly.

Biofeedback practitioners should use their training to tailor the treatment to each individual client, with appropriate use of complementary psychotherapy to facilitate biofeedback treatment.

Disclosures

The authors have nothing to disclose.

References

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