Neurofeedback Training and Skin Resistance

Abstract

Bio-signals (e.g. skin resistance, temperatures) are helpful to find out optimal individual neurofeedback training protocols. This article documents our experience to use RUI Skin Resistance Sensor (RSRS-11C) during neurofeedback sessions, specially for the monopole installation, frequency band training. It helps you, as a neurofeedback therapist or trainer, to find out optimal training protocols for your clients, so that your clients could get effective training results in less training sessions∗.

1. Arousal level and Skin Resistance

Skin conductance, also known as galvanic skin response (GSR), electrodermal response (EDR), psycho galvanic reflex (PGR), skin conductance response (SCR), or skin conductance level (SCL), is a method of measuring the electrical conductance of the skin, which varies depending on the amount of sweat-induced moisture on the skin. Sweat is controlled by the sympathetic nervous system, so skin conductance is used as an indication of psychological or physiological arousal. If the sympathetic branch of the autonomic nervous system is highly aroused, then sweat gland activity also increases, which in turn increases skin conductance. In this way, skin conductance can be used as a measure of emotional and sympathetic responses. It is used as an indicator of arousal level for the neurofeedback sessions.
Skin conductance (GSR or EDR) widely uses mircosiemens as unit, Skin Resistance measured by SRS-11C has the following relationship with skin conductance:
Ski Resistance = 1 / Skin Conductance
Skin Resistance has unit kilo Ohm.
Skin Conductance has the unit micro Siemens.
The figure 3 shows the reference value of skin resistance of an adult.

Arousal level	Skin Conductance	Skin Resistance
Normal arousal level	Less than 10 Micro Siemens	Greater than 100 Kilo Ohm
High arousal level	10 -25 Micro Siemens	100 – 40 Kilo Ohm
Very high arousal level	Greater than 25 Micro Siemens	Less than 40 Kilo Ohm

Figure 1 Skin Resistance and Arousal Level

2. Rui Skin Resistance Sensor (RSRS-11C)

Rui Skin Resistance Sensor (RSRS-11C) is a light, precise sensor for Skin Resistance. It is a product from RUI-Tech GmbH (www.rui-tech.com, www.rui-tech.ch). We use RSRS-11C as an indicator for arousal level during neurofeedback sessions, so that it helps us to find out the optimized training methods, training frequency and training positions.

3. The Principle of Skin Resistance Indication

- During a neurofeedback training session, skin resistance should always stay in the normal arousal level.
  A normal neurofeedback training is a peaceful learning process for the brain, the skin resistance should stay in the range of normal arousal level.
- Skin resistance should vary during a positive training session.
  A successful neurofeedback training session should influence autonomic nervous system, so that the skin resistance should vary in the normal arousal level during the session. For example, when we are doing alpha training correctly, the client is getting relaxed, his/her skin resistance should increase.
- The variation of the skin resistance should match the training goal. For example, if the goal of the training is to increase attention, the skin resistance should decrease. If the goal of the training is to relax, the skin resistance should increase. If the variation of the skin resistance does not match to the training goal, it means the training protocol (training position, frequency, or training time) is not optimal for the client, at least for the moment.

4. Use RSRS-11C to find out the optimal training frequency

The followings are our recommendations to use RSRS-11C to find out optimal training frequency.

Step 1: define training goal, training position and training time.

For example, a goal could be relaxing training (Alpha Training) on Pz for 20 minutens. Another example could be an attention training (Beta Training) on Fpz for 15 minutens.

Step 2: Starting with the middle frequency of the frequency band.

For the alpha training, start with 10HZ. Set the base line of skin resistance in the RSRS-11C window.

Step 3: Watching the variation of skin resistance. Adjust frequency if needed.

Check in every 3 minutens the variation of the skin resistance, if the variation does not match the training goal, increase or decrease the frequency.

Step 4: Repeat the step 3 again until the optimal frequency band for this client is found out.

5.1 Skin Resistance and Neurofeedback Training

From our practices, we got the following:

- Skin resistance increased for all cases during alpha training on Pz, P3, P4

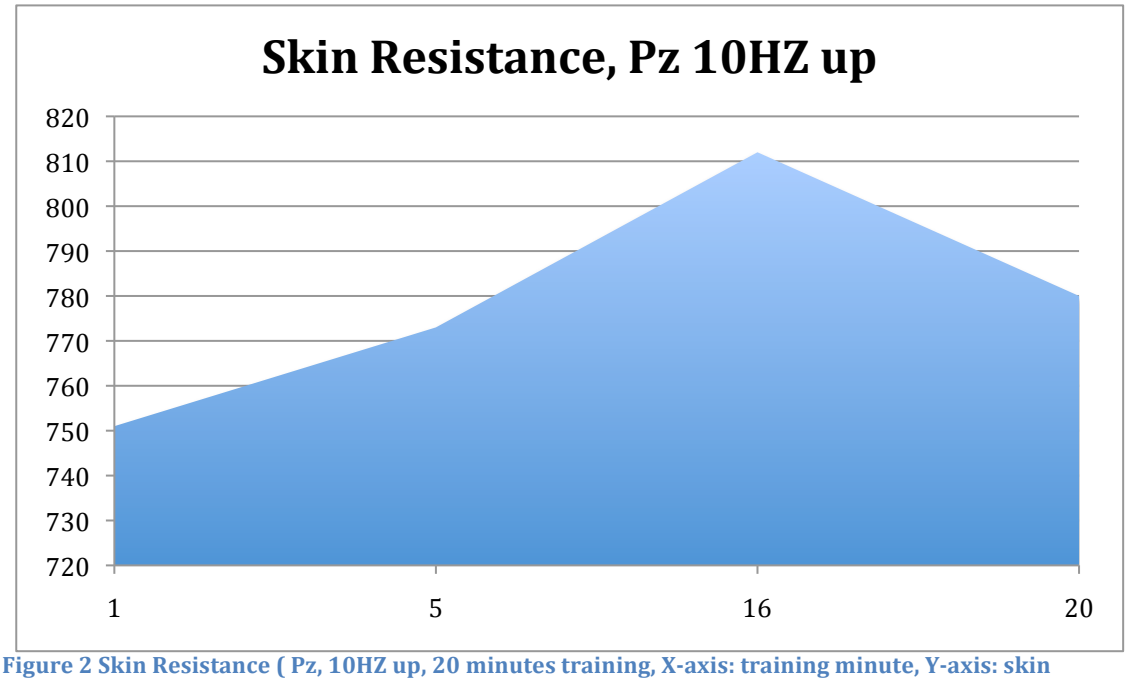

Figure 2 Skin Resistance (Pz, 10HZ up, 20 minutes training, X-axis: training minute, Y-axis: skin resistance, unit kOhm)

**data from client Mr. Wu, session 12 on Nov. 16, 2014.*

- Skin resistance decrease for most of cases during monopolar trainings on C-area, F-area and Fp-area.

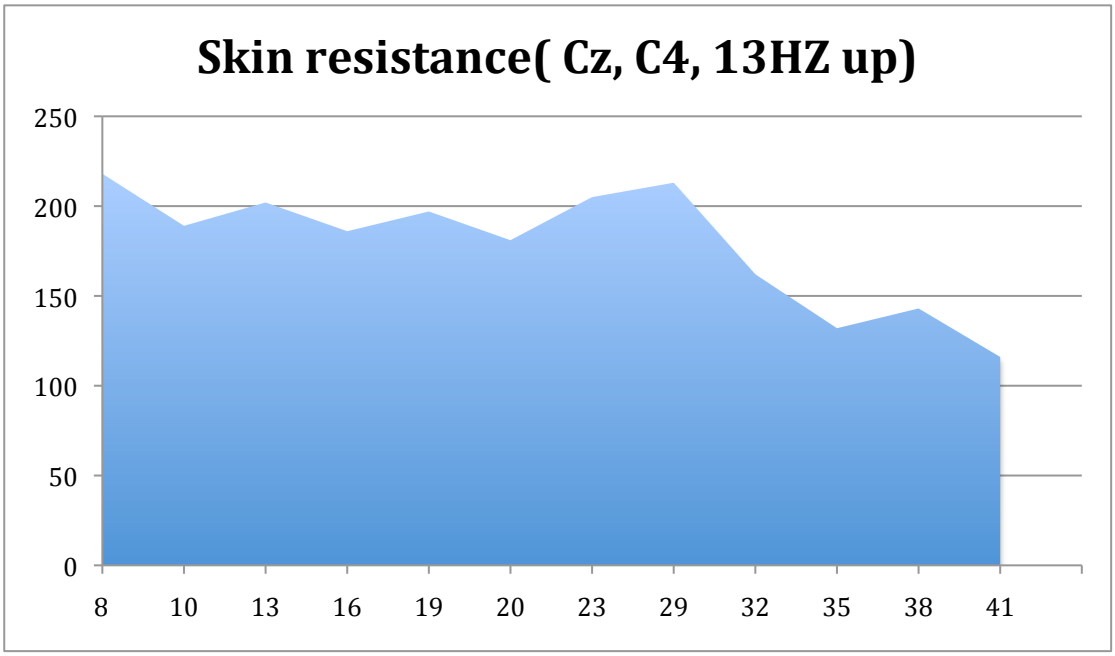

Figure 3 Skin Resistance of one training session (20 minutes training on Cz 13HZ, 21 minutes training on C4, 13 HZ. X-axis: training minute, Y-axis: skin resistance, unit kOhm)

** data from client xxx session 13 on Nov. 15, 2014.*

* The article is to share our experience with other neurofeedback therapists, any feedback is welcome. Please write back to info@rui-tech.com