Electrodiagnosis and electrotherapy

1 Electrodiagnosis

Electrodiagnosis is necessary to determine optimal parameters of denervated muscles stimulation (electrostimulation).
It measures the intensity of rectangular and triangular pulses of standard length that produce visible or palpable contraction of the irritated muscle.
From the diagram with parameters of intensity and time we can get the information about the degree of muscle damage and also parameters of possible treatment.
Rheobase is defined as the minimum electric current of unlimited duration needed to excite a nerve or muscle tissue.
Chronaxy is defined as the minimum time necessary to excite a tissue, such as that of muscle or nerve cells, with an electric current set to twice the rheobase.

Hoorweg-Weiss curve

 dependence of current intensity on time necessary to excite a tissue
To excite a nerve or muscle tissue electrical stimulation has to act for some time - the membrane acts like a capacitor, voltage rises as we charge up a capacitor, and falls as the capacitor is discharged. The effect of electric current is expected to be the amount of charge. With application of rectangular current pulses, the total charge \((Q)\) equals the product of the current intensity \((I)\) and the duration \((t)\): \(Q = I \times t\).

**Objective: \(I / t\) curve measurement**

1) Place the electrodes into the wet covers, fix them (using strips) on the dorsal side of the forearm – one proximally and the other one distally.
2) Use rotary controller to select Menu DIAGNOS on screen, press the controller to confirm.
3) Select the menu IT-CURVE
4) According to your consideration you can change the tone signalization

a) **rectangular pulses measurement (RIC)**

1) Select an arbitrary initial pulse length \(T\) (1000 or 500 ms)
2) Use intensity regulator (circuit I/6) to slowly increase the intensity until you feel a muscle response. Take care on the length of pauses between pulses.
3) Confirm the intensity by pressing the REACTION button - stop dosing of pulses. Value of intensity will automatically be saved. Length of pulses \(T\) will automatically jump to nearest shorter value.
4) Return the value of intensity to 0.
5) Increase again the intensity until you feel a muscle response. Confirm the intensity by pressing the REACTION button - stop dosing of pulses.
6) Repeat this cycle with others pulse lengths \(T\)
7) Each time return the intensity to 0.
b) **triangular pulses measurement (DIC)**
1) Change the shape to triangular pulse.
2) Follow instruction in a).
3) Return the intensity to "0" and leave the electrodes connected.

c) **Evaluation**
1) Take provided I/T curve template.
2) Record the intensity levels for different pulse lengths T (DIC) and change again the length of pulses. You can find appropriate values of intensity levels you can find in the bottom part of the display (**selection field / 3 /**). They are automatically saved to memory and the chronaxy levels are calculated (1000 or 500 ms). Appropriate accommodative quotients are the same as found for the chronaxy levels.

2. **Electrotherapy**
Various types of electrotherapy:
G – galvanic current
DD – diadynamic current (monophasic low-frequency sine current overriding the galvanic). Types of DD curent (The abbreviations used for these different currents relate to the original French terms): **CP**(courant modulé en courtes périodes) , **LP**(courant modulé en longues périodes), **DF**(diphase fixe) and **MF**(monophasé fixe)
TENS – transcutaneous electro neuro stimulation (pulses are shorter than 1 ms)
IF - interferential current (medium-frequency currents, that by passing through a tissue change to low-frequency)

### Used symbols

- **Change of the polarity of both electrodes.** Select (+/-) to make appropriate change of the polarity
- **Intensity indicator, circuit I (mA), adjustable due to intensity regulator, circuit I / 6 / .**
- **Contraction time (set: 1 to 60s) with step 1s; manual button T = 0)**
- **Pause time (set: 1 to 60 sec) with step 1s**
- **Ramp (4 settings) with different levels**
- **Frequency**
Basic frequency

Tone signalization (audible pulses)

Switch between continuous/interrupted galvanic current. Top row indicates status of actual selection

---

Task 1: DD currents and TENS

1) Leave the electrodes connected in the same way as in previous task.
2) Use intensity regulator (**circuit I/6**) to set the intensity of current.
   1) Record its value. Return the intensity regulator to 0.
   2) Do the same for MF, CP and LP.
3) Select TENS. Set the frequency on 2Hz. Use intensity regulator (**circuit I/6**) to set the intensity of current. Record its value. Return the intensity regulator to 0.
4) Select TENS Set the frequency on 10Hz. Use intensity regulator (**circuit I/6**) to set the intensity of current. Record its value. Return the intensity regulator to 0.
5) Leave the electrodes connected.

Task 2: Treatment selection according to the selected indications

Beside direct access to various forms of current, the indications menu offers more options to input various therapeutic forms. In this way you can more effectively use versatile treatment methods.
Follow the instructions of stimulation therapy menu. Leave the electrodes connected in the same way as in previous task.

1) Select function IND (selection field / 3 /).
2) Select specific indication in indication menu.
   SVALOVÝ TRÉNINK (means in English: muscle training).
   VÝVOJ SVALSTVA (means in English: muscular development)

3) Select **GRAPHICS**.
   A screen appears with the information where we can attach electrodes on body. This screen has just informative character.

4) Go back from the graphic menu.
5) Set T to 2s and R to 2s.
6) Select **THERAPY** function.
7) Set T to 2s and R to 2s.
8) Use intensity regulator (**circuit I/6**) to set the intensity of current. Record its value. Let the therapy run for 1 min. Return the intensity to 0.
9) Remove the electrodes.