SCENAR: the secrets of effectiveness

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A few words about electrotreatment

Galvanization is low-strength (under 50mA) and low-voltage (30-80V) direct current. Galvanization exists for 200 years.
A few words about electrotreatment

In the 1950s P. Bernard offered the treatment with alternating current (dynamische currents therapy). In 1963 it was offered to use sinusoidal currents with frequency 5000 Hz, modulated with frequency from 10 up to 150 Hz (amplipulse therapy).
A few words about electrotreatment

Electropulse therapy was developed basing on ‘The gate control theory’ by Melzack R., Canada, and Wall P., England, 1965.
‘Addiction’ and coping with it

There is a problem of electric influence ‘addiction’ - the effect goes down with the lapse of time. SCENAR copes with this problem successfully. The frequency of caused pulse activity vs the frequency of neuron synaptic stimulation (irritation).
SCENAR pulse features

SCENAR generates two-phase bipolar pulses with insignificant constant component.
SCENAR pulse features

Such shape is called ‘neural-like’, as it is similar to myopulses and cardiopulses (particular case of myopulses). Their characteristic feature is exactly two-phase structure: I-st phase – depolarization II-nd phase – repolarization
SCENAR pulse features
SCENAR pulse features

High-amplitude

Energy=75
SCENAR pulse features

With limited energy (undamaging)

<table>
<thead>
<tr>
<th></th>
<th>Measured $U_{rms}$, V</th>
<th>Average power, W</th>
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<tr>
<td><strong>500 Ω</strong></td>
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<td>10.3</td>
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<tr>
<td>InterX5000</td>
<td>13.8</td>
<td>0.019</td>
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SCENAR pulse features

High-variative (Energy=20, 1\textsuperscript{st} and 30\textsuperscript{nd} sec)
How SCENAR pulse forms?

1st phase
SCENAR pulse vs load

No load
SCENAR pulse vs load

Back of the hand

Palm
SCENAR pulse vs load

Self-adhesive electrodes, Energy=250
SCENAR pulse vs load

\[ \omega = \frac{1}{\sqrt{LC}} \]

\[ T = \sqrt{LC} \]

\[ IR = Const \cdot \sqrt{C} \]

\[ C = \frac{(IR)^2}{K}; \quad K \sim 1 \]

<table>
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<tr>
<th>( C_{\text{sim}} )</th>
<th>IR</th>
<th>( C_{\text{calc}} )</th>
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<tr>
<td>10</td>
<td>300</td>
<td>140</td>
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<td>15</td>
<td>20</td>
<td>320</td>
</tr>
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<td>30</td>
<td>570</td>
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<tr>
<td>1 300</td>
<td>50</td>
<td>1 300</td>
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<td>3 600</td>
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<td>230 000</td>
<td>220000</td>
<td>400</td>
</tr>
<tr>
<td>510 000</td>
<td>600</td>
<td>910 000</td>
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</tbody>
</table>
SCENAR pulse features

**Summary:**
- two-phase bipolar (neural-like);
- high-amplitude, but undamaging;
- high-variative (no addiction).
SCENAR pulse features

Questions?
Break...
Available settings
Available settings: ‘Energy’

Basic parameter, its regulation is available in all devices and in the same limits. Max/min amplitude rate is from 50 to 100 times. For energy it corresponds to more than 2500 times.
Available settings: ‘Energy’

Energy changes from 20 to 250.
Available settings: ‘Energy’

While increasing the energy the sensations are changing from their absence to painful ones. At comfortable electric influence level it is felt as pulsation, pricking, vibration.

Consequently, there is a scale of influence:
- subthreshold level,
- threshold level,
- comfortable level,
- uncomfortable level,
- painful level.

Even at subthreshold level the influence goes. The result is not always proportional to the strength of sensations.
Available settings: ‘AM’

Amplitude modulation (AM) is the influencing pulse amplitude changing during the time according to a rule. It is available in all devices completely or partially.
Available settings: ‘AM’

AM: alone pulse
Available settings: ‘AM’

AM: pulses’ bursts

AM=Off

AM=3:1
Available settings: ‘AM’

When AM is on it is felt only increasing and decreasing of influence strength.
Available settings: ‘Bee’

‘Bee’ is one of the ‘AM’ modes. The device at minimal energy is waiting for the skin contact. Right after the contact it gives 1 or more pulses with maximal energy. Is available only in the highest SCENAR device.
Available settings: ‘Bee’

‘Bee’ mode with ‘Int=1’
Available settings: ‘Bee’

When ‘Bee’ is on, right after the skin contact it is felt high short influence like Bee sting.

‘Energy’ settings does not affect ‘Bee’ strength. It can be regulated only with ‘Intensity’ settings.
Available settings: ‘Frequency’

Frequency is quantity of pulses per second. Is available in all devices completely or partially.

F=30Hz

F=120Hz
Available settings: ‘Frequency’

While changing the frequency the changes of both – the strength and the ‘volume’ of influence are felt.
Available settings: ‘FM’

Frequency modulation (FM) is the influencing pulse frequency changing during the time according to a rule. Is available in all devices except for the lowest CHANCE.
Available settings: ‘FM’

As well as while changing the frequency manually the changes of both – the strength and the ‘volume’ of influence are felt.
Available settings: ‘Intensity’

The quantity of pulses in a burst. The space between pulses in the burst (gap) is smaller than the space between bursts. Is available in SCENAR devices except for the lowest one.
Available settings: ‘Intensity’

While changing the intensity the changes of both – the strength and the ‘depth’ of influence are felt. That’s why there is another name for intensity – ‘depth’.
Available settings: ‘Gap’

The gap is a space between pulses in a burst. It has the sense only for intensity 2 and more. Is available in SCENAR devices except for the lowest one.
Available settings: ‘Gap’

While changing the gap the changes of the ‘depth’ of influence are felt as well as a kind of pulses ‘rotation’.
Available settings: ‘Damping’

It means the pulses initial shape changing and the law of their changing depending on the load. Is available in SCENAR devices except for the lowest one.
Available settings: ‘Damping’

Without load
Available settings: ‘Damping’

High resistance of the load
Available settings: ‘Damping’

Load with high capacity
Available settings: ‘Damping’

While changing the damping the changes of the ‘softness’ or the ‘sharpness’ of influence are felt.
Available settings: ‘Swings’

Swings are combined modulations. They are simultaneous autochanges of frequency (FM), gap, damping. In Sw4 mode the intensity is changing too. They are available in SCENAR devices except for the lowest one.
Available settings: ‘Swings’

Example of Sw4
Available settings: ‘Swings’

When any Swing is on, the simultaneous changing of ‘softness’, ‘depth’ and ‘volume’ of influence are felt.
Available settings

Questions?
Break...
Dose, Zero, Rate...
Dose, Zero, Rate...
Dose, Zero, Rate…

Initial Reaction (IR) is length of the 2d phase’s first pulse. The difference between IR and current (ongoing) reaction (CR) is that IR is average parameter in 1st second and CR is average parameter in current second.
Dose, Zero, Rate...

**Shape coefficient (SC)** is quantity of oscillation half-phases (or zero crossing) during Phase 2. **Initial Shape coefficient (IS)** is average SC in first second and **Current Shape coefficient (CS)** is average SC one in current second.
**Speed** is relative speed of current reaction changing in percentage per second.

\[ V = \frac{100\% \bullet (R_t - R_0)}{R_0 \bullet t} \]

Ro – initial reaction,
Rt – current reaction,
t – time of the point treating,
V – reaction speed.

Exact formula for the speed is

\[ V = \frac{128\% \bullet (R_t - R_0)}{R_0 \bullet t} \]

This way is easier to calculate for microcontroller.
Dose 1

Dose 1 – adaptive dose + integrated zero. Dose (*) means that over the full time the zone was stimulated, the reaction has changed ENOUGH (according to our criterion). Zero (@) means the speed became less than 1%/sec.
Dose 1

Low dynamics – long dose
Speed and Zero

Low speed – quick Zero
Speed and Zero

High speed – long Zero
Dose 2

Dose 2 – zero and dose together, differential dose/zero. That is for Dose 2 the speed is counted relatively to the reaction on previous second. Dose appears after 3 seconds of non-positive speed/dynamic (zero or negative).
Dose 2

Low dynamics – quick dose
Dose, Zero, Rate…

Questions?
The secrets of effectiveness
The secrets of effectiveness

We consider SCENAR efficiency is provided with its pulses’ features and with additional regulations of its parameters. There are physical and (bio)chemical effects approved to different degree.

**Approved local effects:**
- collateral circulation increasing,
- anti-inflammatory,
- analgetic,
- antiedematous,
- genetic...
Energy influence concentration

Right hand: palm – back of the hand.
Left hand: palm – back of the hand.
Right hand, palm – left hand, back of the hand.
Left hand, palm – right hand, back of the hand.
High-frequency massage

Construction of electrostatic loudspeakers

1 – flexible electrode,
2 – fixed electrode
High-frequency massage

Voltage-to-sound skin conversion

1 – horny layer (corneal layer);
2 – clear layer (lucid layer);
3 – granular layer;
4 – prickly layer;
5 – basal layer;
6 – dermis, hypodermis;
   subcutaneous tissues;
7 – device electrodes.
High-frequency massage

Influence force estimation

\[ F = \frac{U^2 \cdot C}{2d} \]

\[ F = \frac{50^2 \cdot 0.22 \cdot 10^{-6}}{2 \cdot 5 \cdot 10^{-5}} = 5(N) \]
Skin vibration

Electric pulses enable the substances to penetrate inside, while vibrations stimulate certain receptors. While preparing competent cells, shaking is ordinary procedure. Therefore, we expect electroporation effect increasing.
Fluid structuring
Fluid structuring

Charge distribution in water atoms

Water molecule arrangement after the voltage sign changed
Electroporation is a significant increase of the cell membrane permeability caused by externally applied electric field of high intensity.
Electroporation

As a result of electroporation the DNA fragments penetrate from tissue liquid into cells.
Physiological effects in ‘soft’ reversible electroporation on cellular level:
- cell metabolism acceleration,
- cells activation,
- increase in production and acceleration of proliferation.

on tissue level
- improves functionality of microvasculature,
- increases the perfusion of tissue fluid,
- accelerates the immune reaction,
- increases the level of antioxidative enzymes,
- decreases the inflammatory process,
- inhibits oxidative stress.
Electroporation

Intensity and duration of electric field for each system of cells is selected empirically, while great variety of SCENAR stimulation modes enables the user to apply this empirical mechanism.
The secrets of efficiency

The SCENAR efficiency sources:
- electroporation and its effects,
- energy influence concentration,
- high-frequency massage,
- skin vibrations...
Bibliography

- Grinberg J.Z., Unakafov M.A. Method of electroinfluence on living organism and the device for realization. The invention description for the patent of RF №2325929 A61N1/08, 1/36, G01R27/00, published 10.06.2008г., №16.
Bibliography


Good luck!