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PRINCIPLE OF CONTROL ULTRASONIC PHYSIOTHERAPY DEVICES

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When using ultrasound therapy devices in physiotherapeutic practice, the relevance of their actual output parameters is of paramount importance. However, according to research results, the accuracy of the ultrasound apparatus, unfortunately, is low. Extremely common cases are when the initial parameters of ultrasound machines do not meet the established requirements, despite regular calibration. In case of use of ultrasound machines whose initial parameters are inaccurate, two main scenarios of the development of the situation are possible: in the first case, the patient may receive an excessive dose of ultrasound, which can endanger the patient's health and lead to injuries; in the second case, the patient may receive a lower dose than the doctor appointed, which could potentially compromise the effectiveness of the treatment.

Therefore, we propose to solve this problem using a method of controlling the initial ultrasound parameters of ultrasound apparatus [1]. By creating and implementing a control system with biological feedback [2], in this case - by the temperature of biological tissues. The difference in temperature, which is established in the state of thermal equilibrium, is between the center of a well absorbing sphere of radius r (temperature T_0) and its environment (T_∞) [1]:

$$\Delta T = T_0 - T_\infty = \frac{\mu \cdot I}{2k} \cdot r^2 \ , \tag{1}$$

where $Q = \mu \cdot I$ is the rate of heat release in unit volume, μ is the decay rate in intensity [Np/cm], I is the intensity [W/cm^2], k is the thermal conductivity [W/(cm·°C)] [1].

In our opinion, this decision will solve the problem in the development of new ultrasound devices.

References

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