HIGH-FREQUENCY PHYSIOTHERAPEUTIC ELECTRONIC DEVICES AND ELECTROSURGICAL (ELECTROSURGERY) DEVICES

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Abstract *This article discusses the principles of operation, physical foundations, types and clinical applications of high-frequency physiotherapeutic electronic devices and electrosurgical (electrosurgery) devices widely used in medical practice. The effect of high-frequency currents on biological tissues, their use for therapeutic and surgical purposes are analyzed on a scientific basis. The advantages, safety rules and importance of these devices in modern medicine are also considered.*

Keywords: *high frequency, physiotherapy, electrosurgery, electrocoagulation, diathermy, biological tissue, electromagnetic field.*

Introduction

High-frequency electrical energy–based devices play a crucial role in modern medicine, particularly in physiotherapy and surgical practice. These technologies enable effective treatment and surgical interventions with minimal tissue damage. This article provides an academic overview of high-frequency physiotherapeutic electronic devices and electrosurgical equipment, focusing on their principles of operation, classifications, and clinical significance.

High-Frequency Physiotherapeutic Electronic Devices

General Overview

High-frequency physiotherapeutic devices operate using electrical oscillations typically ranging from 100 kHz to several MHz. Their therapeutic effect is primarily based on controlled heat generation within biological tissues, leading to improved blood circulation, reduced inflammation, and enhanced tissue regeneration.

Mechanism of Action

High-frequency currents induce oscillatory motion of ions within tissues, resulting in:

endogenous heat production;

vasodilation;

acceleration of metabolic processes.

Importantly, such currents do not stimulate nerves or muscles directly, ensuring painless therapy.

Main Types

Darsonval devices

Ultra-high-frequency (UHF) therapy units

Inductothermy devices

Diathermy equipment

Clinical Applications

musculoskeletal disorders;

neurological conditions;

chronic inflammatory diseases;

dermatological treatments;

post-traumatic rehabilitation.

Electrosurgical Equipment

Concept of Electrosurgery

Electrosurgery involves the application of high-frequency electrical currents to cut, coagulate, or ablate biological tissues. Compared to conventional surgical instruments, electrosurgical devices significantly reduce intraoperative bleeding.

Operating Principle

Electrosurgical units typically function in the 300 kHz to 5 MHz range. When electrical energy is delivered to tissue:

intracellular fluids heat rapidly;

cellular structures disintegrate;

tissue cutting or coagulation occurs.

Types of Electrosurgical Devices

Monopolar systems

Bipolar systems

Electrocoagulators

Radiofrequency surgical units

Advantages

minimal blood loss;

reduced surgical time;

lower infection risk;

faster wound healing.

Medical Significance of High-Frequency Technologies

High-frequency physiotherapeutic and electrosurgical devices have:

enhanced non-invasive treatment methods;

improved surgical safety;

shortened patient recovery periods;

laid the foundation for modern minimally invasive procedures.

Conclusion

High-frequency physiotherapeutic electronic devices and electrosurgical equipment constitute an essential component of contemporary medical practice. Their scientifically grounded mechanisms, broad clinical applications, and high efficiency significantly improve patient care quality. Continued technological advancement in this field promises further innovation across multiple medical disciplines.

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