What's the Buzz - An Essential Primer on Electrotherapy
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The human body relies on a complex, intricate electrical system that governs various physiological functions through specific channels. This system facilitates the rapid, uninterrupted transmission of electrical signals, which are essential for all bodily processes. Electrical energy in the body is generated by the movement of charged ions across cell membranes, enabling key functions such as muscle contraction, nerve transmission, and organ function. These electrical signals can be detected and, if necessary, modified. For example, an electrocardiogram (EKG) measures the electrical activity of the heart, while an external electrical shock can be delivered to "reboot" the system if the heart stops. Similarly, implanted devices such as pacemakers regulate heart rhythm, and defibrillators provide a shock when necessary.

Electroencephalograms (EEG) measure the brain's electrical activity, which is linked to consciousness, thought, cognition, and sensory and motor functions. Electrical devices are also implanted in the brain or along cranial nerves to treat conditions like Parkinson's disease and epilepsy by overriding abnormal signals and facilitating more normal movement patterns. Electromyograms (EMG) detect the electrical activity of muscles, and external electrical devices are frequently used to restore proper signaling between muscles and nerves, addressing issues like muscle weakness, spasticity, pain, and circulatory disorders. Some devices activate electrical signaling, while others inhibit abnormal or noxious signals.

In summary, the body's reliance on electrical signaling is fundamental to its function, and numerous devices are designed to replicate this signaling in medically necessary ways.

This knowledge is not new—electrotherapy has been in use for thousands of years. The ancient Greeks, Egyptians, and Romans first harnessed electricity for therapeutic purposes. Early methods involved the use of the electric ray (Torpedo fish), which could generate electrical potentials of 20 to 50 volts. These fish were used as rudimentary defibrillators and to treat muscle weakness, pain, gout, and wounds—purposes similar to those of modern electrical stimulation devices. The first devices capable of delivering electrical impulses were developed in the 18th century, further cementing the therapeutic role of electricity in the body.

The scientific foundation for electrotherapy was further solidified by figures such as Hippocrates, Luigi Galvani, Michael Faraday, Benjamin Franklin, Alessandro Volta, and others. One key milestone came in 1963, when Sir Andrew Fielding Huxley received the Nobel Prize for his work on the ionic mechanisms involved in nerve excitation and inhibition, leading to the development of action potential theory. The discovery that electrical signals govern nerve function is undeniable, providing a solid basis for the application of electrotherapy.

The central takeaway is that electrical energy is vital for human function, and when the body's electrical system malfunctions, external electrical stimulation offers a scientifically backed method of correction.

Electrotherapy is broadly defined as the use of external electrical stimuli to elicit a physiological response. In simple terms, this involves using a device (placed on or inside the body) to deliver a stimulus, expecting a corresponding response from the body. The body's response to these signals depends on how they are delivered—the combination of parameters such as frequency, pulse duration, amplitude, and contraction time. This "recipe" determines the outcome. For example, signals designed to alleviate pain are distinct from those meant to activate muscles or reduce swelling. A clear understanding of these parameters is essential for the effective application of electrotherapy in rehabilitation. In other words, the parameters matter: improper settings lead to poor outcomes, while the right settings deliver the desired results.

Many researchers fail in their investigation of electrotherapy by overlooking or misunderstanding these parameters. Any study that does not provide precise details about the applied parameters is incomplete and unreliable. Furthermore, using the wrong parameters or incorrect electrode placement is an example of negative confirmation bias, where the failure of a protocol only highlights the importance of using the correct techniques.

One common form of electrotherapy is neuromuscular electrical stimulation (NMES), which is specifically designed to activate muscle groups by eliciting action potentials. When applied correctly, NMES should stimulate nerves and cause muscles to move in a manner that mirrors normal, voluntary movement patterns. This principle is crucial: properly applied NMES should produce muscle movement identical to the way the body's natural electrical signals would trigger it.

In the context of dysphagia therapy, correct electrode placement and the appropriate stimulus are vital. When the electrodes are positioned on the submental region (stimulating the suprahyoid muscles), they should evoke a movement of the hyolaryngeal complex that mirrors the upward and forward motion seen during a normal swallow. However, this alone is not enough for functional improvement. The critical factor is that the patient must perform the swallowing task while the NMES is active.

These are the fundamental principles for using NMES in dysphagia rehabilitation:

1. Electrode Placement: Electrodes should only be placed on the submental region to stimulate the suprahyoid muscles, inducing the correct upward and forward movement of the hyolaryngeal complex.
2. Combination with Swallowing: The electrical stimulus should be combined with an actual swallow, whether volitional or facilitated, to reinforce and reeducate the correct motor pattern.
3. Stimulus Cycling: NMES should alternate between stimulation and rest to promote muscle contraction and recovery. A 1:3 work-rest ratio is standard for muscle re-education.
4. Comfortable Stimulus: The stimulation should never cause pain, burning, or discomfort. A skilled practitioner understands how to adjust parameters to achieve effective contraction without causing discomfort.
5. Proper Patient Selection: Not everyone is a candidate for NMES. Patient selection is critical for success.
6. Competency: A practitioner must fully understand the underlying principles of NMES and be able to apply the correct stimulus at the correct time with the correct parameters for the desired outcome.
7. Parameter Range: The parameters for NMES are well-documented in the literature. Any modifications should stay within these established standards.

By adhering to these principles, NMES can be an effective tool in dysphagia rehabilitation, providing measurable improvements in swallowing function when applied correctly.

In summary, the scientific foundation for electrotherapy as a valuable and logical modality for rehabilitation is well established. While some may argue that electrotherapy is evidence-based for many conditions, they contend that the same principles cannot automatically be applied to dysphagia. However, there is no need for speculation or extrapolation in this case. The historical evidence supporting electrotherapy for dysphagia is both rich and long-standing, dating back to 1893, when German scientist Fredrick Rethe first used electrical impulses to stimulate swallowing function in rabbits.

Unlike most therapeutic techniques used for dysphagia, neuromuscular electrical stimulation (NMES) boasts a robust body of animal research from the 1960s, with the first documented human study appearing in 1973. This field experienced a surge in research beginning in 2000, resulting in hundreds more published articles.

The vast majority of these studies demonstrate the efficacy of NMES. In cases where efficacy is not shown, fundamental flaws are often present—such as inappropriate stimulus parameters, incorrect electrode placement, poor patient selection, or suboptimal application methods. Therefore, a thorough understanding of NMES principles is essential not only for designing clinical trials but also for accurately interpreting the literature.

Key Points:

- NMES is effective when applied correctly and with a comprehensive understanding of its principles.
- Application of NMES for dysphagia is specific to the trajectory of movement of the hyolaryngeal complex which facilitates airway closure and UES opening
- However the benefits are not limited to only those components as the cortex reorganizes and the system as a whole recovers as a result of the stimulation
- Principles of NMES dictate that the external stimulus must be in synchronicity with the act of swallowing
- NMES is a safe and effective modality
- NMES provides a physical agent that has a direct impact on sensory and motor recovery beyond the capacity of any exercise by facilitating metabolic, cellular, and structural change
- The evidence for NMES in dysphagia rehabilitation is more than sufficient.

Perhaps the question you should be asking is not, “Is NMES for dysphagia safe or efficacious?”—because it is—but rather, “Why haven’t I learned this yet?”

After all, why deprive someone with dysphagia of such a powerful, proven and safe intervention—one that could make the difference between eating and not eating?”

The significant psychosocial impact and medical necessity of dysphagia demand our best efforts, utilizing the most effective tools available. NMES is one such tool—embrace it or risk losing its potential benefits!

NMES works if you understand it and use it correctly!

I invite any questions or comments and encourage you to check out my website thebiberprotocol.com which provides a wealth of information in both text and video form.

Thank you for allowing me this opportunity to share and I look forward to hearing from you!