PEMF and Mitochondrial Potentials

Does the application of Pulsed Electromagnetic Field Therapy (PEMF) address health decline in humans by maintaining mitochondrial membrane potential? Mitochondria is the power cell found in most eukaryotic organisms….yes that includes human beings too… which produces ATP (adenosine triphosphate) the source of chemical energy required for cellular metabolism.

Mitochondria produces ATP through oxidative phosphorylation (**OxPhos**).
(See animation)

PEMF History:
Pulsed Electro-Magnetic Field Therapy (PEMFT) was first introduced by Nicol Tesla at the end of the 19th century and has since been used as a therapeutic alternative for the treatment of arthritis, pain, insomnia and general muscle and joint issues.

In 1979 the FDA *(Food and Drug Administration USA)* allowed electromagnetic fields to be used on humans for non-union fractures and bone healing. Ten years later, it was extended to treat pain and oedema in soft tissue.

Much scientific research over the proceeding years has resulted in significant positive findings regarding the influence of PEMF therapy.

Increased General Well-being:
While age-related degenerative issues such as osteoarthritis, bone fractures and soft tissue healing have been the focus, it has been extensively reported by many users of PEMF that a feeling of general well-being is a welcome side effect.

Scientific research now suggests it is reasonable to suggest that PEMF therapy exerts stimulation of mitochondrial OxPhos, resulting in increased mitochondrial membrane potential, generating ATP.

Increased Cellular Energy (ATP):
From the results of scientific research combined with overwhelming anecdotal evidence, there is little doubt that using PEMF through the Oska Pulse will improve well-being and slow the decline of the ageing process in us humans.

Oska Pulse:
The Oska Pulse is registered in Australia as a Medical Device Class 2a. Its primary function is to speed the body's natural healing process. Portable, wearable technology is fast becoming a viable alternative to the long-term use of painkiller medication. See more about Oska Pulse here.

Looking further……..

The Mitochondrion – Powerhouse

Mitochondrion (plural: mitochondria) are double-membrane-bound organelles present in eukaryotic cells. The mitochondrion, often referred to as the "powerhouse" of the cell, serves a crucial role in cellular respiration, the process by which cells convert nutrients into energy in the form of adenosine triphosphate (ATP).

Here are some important mitochondrial facts:

1. **Structure**: Mitochondria have a distinct structure consisting of two membranes—an outer membrane and an inner membrane—that enclose the organelle's contents. The inner membrane is folded into numerous cristae, which provide an increased surface area for various chemical reactions.

2. **Energy production:** The primary function of mitochondria is to produce ATP through cellular respiration. This process involves the breakdown of glucose and other nutrients using oxygen (aerobic respiration) to generate energy-rich ATP molecules. The electron transport chain and oxidative phosphorylation are two essential processes that occur within the inner mitochondrial membrane during ATP production.

3. **Mitochondrial DNA:** Mitochondria contain a small amount of their own genetic material, known as mitochondrial DNA (mtDNA). This DNA encodes essential proteins and RNAs necessary for the mitochondria's function and replication. Unlike nuclear DNA, which is inherited from both parents, mtDNA is typically inherited solely from the mother.

4. **Apoptosis regulation:** Besides energy production, mitochondria also play a role in regulating cell death through a process called apoptosis. They release certain proteins that trigger apoptosis, which is an essential mechanism for maintaining tissue integrity, removing damaged cells, and controlling cell growth.

5. **Cell signalling and metabolism:** Mitochondria are involved in various metabolic processes and signalling pathways within the cell. They participate in calcium ion regulation, which is crucial for cell signalling and muscle contraction. Additionally, mitochondria are involved in fatty acid metabolism and the synthesis of certain molecules.

6. **Diseases and disorders:** Mitochondrial dysfunction can lead to a range of health issues. Inherited mutations in mitochondrial DNA or nuclear genes related to mitochondrial function can cause mitochondrial diseases. These disorders often affect tissues and organs with high energy demands, such as the brain, muscles, and heart.

Does PEMF help mitochondria to increase ATP production?

PEMF (Pulsed Electromagnetic Field) therapy is a medical treatment that employs electromagnetic fields to enhance various cellular functions. Some evidence suggests that PEMF may have beneficial effects on mitochondrial function, which may result in an increase in ATP production.

Here are some potential ways PEMF may influence mitochondria and ATP production:

1. **Enhanced electron transport chain (ETC):** The electron transport chain is an essential component of cellular respiration, in which electrons are transferred along a series of protein complexes within the inner mitochondrial membrane, resulting in the production of ATP. PEMF could potentially affect the activity of these protein complexes, resulting in enhanced ATP synthesis efficacy.

2. **Improved mitochondrial membrane potential:** PEMF has been suggested to enhance the mitochondrial membrane potential, which is essential for the efficient functioning of the ETC and ATP production.

3. **Increased oxygen utilization:** PEMF might influence cellular oxygen utilization, which is a crucial factor in aerobic respiration—the process by which mitochondria generate ATP using oxygen.

4. **Redox balance:** PEMF could potentially influence the redox balance within mitochondria, leading to improved cellular energy production and reduced oxidative stress.

Conclusion:
Several studies have explored the effects of PEMF on mitochondrial function and ATP production in various cell types and animal models. While some of these studies have shown promising results, others have reported mixed findings. Moreover, the specific PEMF parameters (such as frequency, intensity, and duration) that might be most effective in influencing mitochondria and ATP production are not yet fully understood.

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Electromagnetic stimulation increases mitochondrial function in osteogenic cells and promotes bone fracture repair | Scientific Reports (nature.com)