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FOCUSED ULTRASOUND INVOLVING THE USAGE OF CELL RESONANCE TO UNDERSTAND THE EFFECT AND ITS USE AS A THERAPY FOR DISEASE MODIFICATION

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Abstract:
This was a systematic review subjected to determine the value of Focused Ultrasound involving the usage of Cell Resonance to understand the effect and its use as a therapy for disease modification. Focused ultrasound is an emerging technique that utilizes acoustic energy to anatomical targets in an attempt to minimize the pathologies that are going on undercover. Although the conventional allopathic medicine is playing its part in the treatment of several diseases, it has limited role in the efficient treatment of several diseases such as cancer. This study includes original experiments, review articles, reports, studies using human models for the trials and investigations from last 20 years. The aim of this paper is to collect and analyze the research that has been done so far on the subject matter and to present a review on the technique. As this is a new technology, the data on the subject is scarce due to its ethical considerations for human trials.
Keywords: *"focused ultrasound", "focused ultrasonography", "music medicine", "cell resonance" and "FUS in medicine",*

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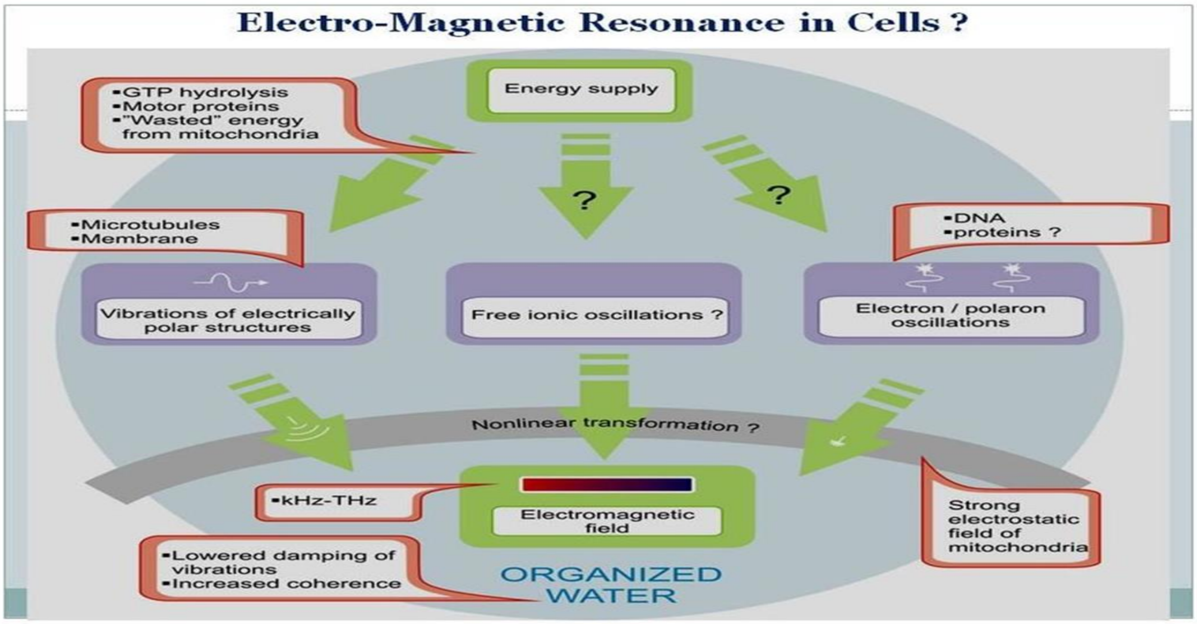
INTRODUCTION:

The structure of the human cell is a complex factory that makes proteins, including tissue materials (Cowin & Doty, 2007). Resonance in cells is responsible for exchange of energy and information among cells. Resonance phenomena are known in the vibratory system in which recipient of the oscillation becomes the receiver when the same frequency, the opposite algebraic sign or the reversed phasing, and the same waveform, that is, identical modulations are present (Meyl, 2011).



Another property is that there are electric and magnetic interactions between cells while communicating. Contrariwise, if the information was at first dissimilar, the genetic code will be pulled from the sender to the receiver, which would have interfered with the form of the resonance. if, identical information is present on both sides. This demonstrates that no evolution could have happened without introns (Meyl, 2012).

The hypothesis of bio-resonance states that detecting the waves emitted from damaged cells or organs can provide critical information in diagnosing disease. Similarly, the theory holds that changing the waves back to their fundamental frequencies can treat unhealthy cells (science behind bioresonance, 2016).

The process of disease or damage diagnosed through bio-resonance involves placing electrodes on the skin of an individual and connecting them to a machine that interprets the emitted wavelengths. Similarly, treating the condition consists of the device to manipulate the emitted wavelength back to fundamental the fundamental frequency of body cells (science behind bio resonance, 2016).

The bio resonance device operates by utilizing the mom-invasive methods for measuring the electromagnetic oscillations emitted from the body in various organs. The measurements are analyzed to provide information on a potential illness or cell damages in the form of unusual wavelengths and oscillations. Healthy organs and cells emit unique but characterized wavelengths ad oscillations that range from 10Hz to 50HZ. When healthy cells and organs are damaged or infected by illness, their general performance becomes altered; therefore, the resultant wavelengths and oscillations become changed too. Computer programs have quantified pathological oscillations that can indicate the presence of illness or cell damage. To achieve this, normal oscillations and wavelengths from healthy cells or body organs are compared to pre-existing measurements. Deviations are then analyzed for further health considerations (How does bioresonance work with cellular communication, 2017).

The wave and frequency distractions can be witnessed in various extend of non-specific disruption in the entire wellbeing, functioning, prolonged fatigue, variations in organic contexts and concentrations, and associated symptoms. Often, symptoms occur at the point of deficiency, such as hereditary. The extracellular body fluid provides a culture medium for cells as well as a deposit site where harmful substances are overloaded after elimination from organs like kidneys, intestines, liver, and gallbladder. Therefore, information from toxic substances is also found in the extracellular body fluids (How does bioresonance work with cellular communication, 2017).

The bioresonance technique can provide essential tools to access and analyses the region in terms of emitted frequencies and wavelengths to determine the health complications of the patient. For example, the presence of viruses, electromagnetic radiations, bacteria, allergies, among other matters (science behind bioresonance, 2016).

Therefore, the regulatory system of the body can be analyzed and treated by restraining its fundamental frequency through bioresonance therapy. The restoration process involves the manipulation of emitted radiations back to fundamental frequencies and sending them back into the body, organ, or cells that were initially infected or damaged. This is done to alter the energy fields of affected cells or organs to trigger the autoimmune system of the body, which in turn improves the health of the patient (science behind bioresonance, 2016).

Researchers at MIT, through their test, "vibrating cells disclose their ailments," determined the frequency of vibration of a red blood cell and explained how the frequency reflects on the heath of cells. The research was performed by a physicist, an engineer, and a material scientist. The researchers indicated that red blood cells have chemical, biological, and electrical activities taking place inside them (Fitzgerald, 2008). The activities result in continuous Nona scale vibrations on the surface of the cell. To determine the frequency of the cell, the researchers utilized the imaging technique together with diffraction phase microscopy, where a laser beam was allowed to pass through the cell. A laser beam passing through the cell was allowed to join another reference laser beam that did not pass through the cell. When the two beams joined, a destructive interface pattern was generated. To establish the relation between the vibration of the cell and its health, the researchers created three-dimensional images of parasites such as a malaria pathogen inside the red blood cell. The amount of hemoglobin in the red blood cell was measured in various stages of malaria infection. Since the vibration of the cell membrane occurs at a very high frequency, for example, in nanometers at a time in microseconds-millionths of a second, the researchers used a laser beam and the imaging technique to capture multiple images as a composite. This capturing technique is part of the tomography, which used the underlying principle of computed-tomography scans (Fitzgerald, 2008).

The possibility of resonance-like phenomena and proposes that mechanically induced oscillations—greater than maximal thermal fluctuations—might lightly high-frequency compatible with low-intensity therapeutic ultrasound (LITUS) ranges-- strain regimes, potentially able to determine fatigue-like phenomena in cells. In particular, the frequency resonance hypothesis assumes that the absorption of ultrasound by proteins and protein complexes may directly alter signaling mechanisms in the cell, determining conformational shift or disrupting multimolecular complexes at serious frequencies around both 45 kHz and 1 MHz (Johns, 2002).

The serious frequencies associated with oscillation magnitude peaks (from tens of kilohertz to hundreds of kilohertz) showing that mechanical resonance-like phenomena lead to thermal fluctuations and this could be helpfully used for aiming how altering the purposes of tumor cells (Fraldi et al., 2015) . On observation of endothelial cells, it was found that when it was exposed to steady flows (decreased frequency content) differs from those exposed to pulsatile flows (containing frequency content), supposing that frequency content is a significant regulator of EC phenotype 12. Recently some evidence showed that stresses of multiple frequencies control endothelial nitric oxide synthase (eNOS), cell proliferation and many inflammatory genes (Barakat & Lieu, 2003, Himburg et al., 2007 and Kadohama et al., 2007).

In vivo human stress waveforms simultaneously composed of numerous frequency harmonics with amplitudes that vary in several orders of magnitude 15 as physiological shear stresses influence EC migration, ER stress, matrix deposition, permeability and inflammatory signaling that translate to in vivo biology (Feaver & Hastings, 2008; Mack, 2008 and Gelfand et al., 2011). Many of these responses are dependent on platelet endothelial cell adhesion molecule-1 (PECAM-1) that forms a mechanosensory complex (Tzima et al., 2005).

There is a parameter describing the relative influence of the frequency content versus the time be close to the content of hemodynamic waveforms, definitely correlated with proatherogenic regions of the human internal carotid artery (Gelfand et al., 2006 and Feaver et al., 2013). This suggested that atheroprone regions are exposed to hemodynamics dominated by the complex frequency content, whereas atheroprotective regions are dominated by the 0th harmonic. Certain frequency components contained in atheroprone and atheroprotective hemodynamics influence the basal inflammatory phenotype in endothelial cells (ECs) (Feaver et al., 2013).

Study Design

This was a systematic review subjected to determine the value of Focused Ultrasound involving the usage of Cell Resonance to understand the effect and its use as a therapy for disease modification. The study was conducted in the time duration of 6 months, i.e. from July 2019 to December 2019. Electronic search was done on EBSCO, PubMed, Medical Literature Analysis and Retrieval System Online (MEDLINE) and Web of Science.

Inclusion and Exclusion Criteria

This study included original experiments, review articles, reports, studies using human models for the trials and investigations from last 20 years. All the papers with content related to therapeutic role of focused ultrasonography in medicine and oncology were collected and analyzed. The exclusion criteria were: abstracts, books, editorials, newspaper articles, and expert opinion of commentary, discussions and the experiments involving animal trials.

Data Extraction

Two reviewers independently assessed each study against predefined eligibility criteria and extracted the following information: (1) authors and publication year; (2) the type of experimental animals; (3) the protocol of Focused ultrasound and Cell resonance; and (4) the main finding of each study. The disagreements were solved by a third assessor. For human studies, we also qualitatively focused on the safety issues regarding the application of this technique. According to the predefined criteria, 10 studies were selected, read in full and analyzed regarding the objectives, type of study, human controlled trials and their outcomes.

METHODOLOGICAL QUALITY ASSESSMENT OF INCLUDED STUDIES:

Although the quality of the methods was the fundamental idea of this review, the chances of selection bias were there. Involved at least two assessors to select and analyze relevant studies and extract data reduces the potential risk of selection and extraction bias. It also minimized the possibility of unintentional exclusion of relevant reports and studies, and extraction of irrelevant data resulting in distorted conclusions.

RESULTS AND DISCUSSION:

Focused ultrasonography is a non-invasive technique usually used in the earlier stage of treatment and has the potential to treat numerous diseases by targeting organs lying deep in the body without the need for an incision.

In this study, heterogeneous types of studies were discussed. The articles were based on different types of study designs focusing on the hypothesis that cell resonance can be used as a therapeutic measure for the treatment of multiple diseases. A study was conducted by researchers focusing the dermis subsequently in acoustic skin equivalents, such as in a bovine liver and a tissue-mimicking gel by using a new 20 MHz High intensity focused ultrasound system (TOOsonix ONE-R). Morphological characteristics, i.e. depth and diameter of HIFU lesion were observed. During the exposure, increase in temperature as a factor of acoustic power was determined. The system aids in the prediction and configuration of 1-2 mm deep lesions, which is the depth of human skin. The lesion was 0.1-0.5 mm in size and elongated triangle in shape. The mode of setting depicted the temperature of the focal point ranging between 40 and 90°C. Porcine muscle and bovine liver were used for the confirmation of the results ex-vivo. Linear effects were observed by varying acoustic power and the time period of exposure. The results revealed that 20-MHz HIFU lesions of controlled localization, morphology and size can be produced in the instrumental setup of choice which are reproducible. The lesions can be produced within specific temperature ranges (Bove, Zawada, Serup, Jessen, & Poli, 2019). In a similar study carried out to develop a method to diagnose malignant skin lesions involving the sonograms. 220 cases out of 400 were malignant, while rest of the cases were benign. The frequency of ultrasound was set at 50 MHz. The study included discrete cosine transform (DCT) and Otsu's thresholding method, used for biomedical image processing, which showed that this method is useful for the detection of skin malignancy (Kia, Setayeshi, Pouladian, & Ardehali, 2019).

The literature reveals that waves can be used to disrupt any biological cell. In a study, researchers developed a model to distort microbiological cell by using radiations generated by acoustical or optical waves. The proposed model can be opted to observe the impact of bacterial mechanical resonance surrounded by a bubble or other particles in liquid, the destruction of the cell at a specific frequency and to study the sonoporation influenced by resonance in a specified ultrasound field regarding the deformation and increased diameter of pores in the bacterial cell (P. V. Zinin & Allen III, 2009).

A group of researchers studied the effects of ELF-MF exposure on morphological and biophysical properties of human lymphoid cell line (Raji). The results interpreted that 50 Hz EMF can induce the signal transduction pathways in the plasma membrane and modify the cytoskeletal structure by influencing the protein kinase activity (Santoro et al., 1997). Recently, Dunjic et al. developed a software named as SONGENPROT-SOLARIS. This software can convert DNA and/or RNA and amino acids into musical sequences. It was proposed by Joel Sternheimer, a French physicist and musician, on the mathematic bases in which a musical note is linked to DNA or RNA or an amino acid. The sound produced can influence the release of solitons and a specific brain activity. The method developed with the help of this software is called MMT (Molecular Music Therapy). The study involved 91 patients in which a technique was used, i.e. Bi-Digital-ORing-Test (BDORT; before and after treating with MMT) and by this technique multiple clinical symptoms were examined. Basically, the study focused on three molecules, i.e. Sirtuin-1, Telomers and TP-53 and targeted a specific gene to be expressed by using sound sequences. After treating patients with MMT, the outcomes revealed an increased production of the above-mentioned molecules. This shows that this technique can be used treat various diseases efficiently (Dunjic et al., 2020).

Focused ultrasound has a profound influence on many diseases. An experiment was conducted by Yoshida and co-workers in 2019 in which they studied the significance of 220 kHz transcranial magnetic resonance imaging-guided focused ultrasound (TcMRgFUS) along with 5-aminolevulinic acid (5-ALA) and its effects on malignant glioma both in-vitro and in-vivo. The F98 cells were treated with 200 mg/mL 5-ALA and exposed to focus ultrasound (FUS). After 20 hours, Cell viability and death were determined by using tetrazolium-1 assay, followed by triple fluorescent staining and Western blotting. MRI and histopathological analysis was done to observe the decrease in tumor size before and after treating the cells with FUS and 5-ALA. The results suggested that this combination along with Sonodynamic therapy is an effective way to treat malignant glioma (Yoshida et al., 2019). Another similar study was conducted to observe the antitumor effect of a combination of gallium-porphyrin complex, ATX-70 with focused ultrasound. A mouse kidney was implanted with Colon 26 carcinoma and subjected to be exposed to focused ultrasound at 500 kHz and 1 MHz and these frequencies resulted in cavity formation in tumor. Prior to the exposure to ultrasound, the mouse was given a dosage of 2.5 mg/kg of ATX-70 before a time period of 24 h. Follow up was conducted after 7 days to observe the decrease in tumor tissue size. The results of this study also suggested that the combination of ATX-70 with focused ultrasound is effective for the treatment of tumors (Yumita, Sasaki, Umemura, Yukawa, & Nishigaki, 1997).

Ultrasound can also be used to heal fractures and paralysis. To justify this hypothesis, Poliachik along with other researchers conducted an experiment by using a mouse model which was tested for onabotulinumtoxinA-induced paralysis, resulting in bone loss in five days. A focused transducer of 2 MHz was used to expose pulses with repition frequencies mimicking a motor neuron which releases 80 Hz during walking, 20 Hz while standing, or 1 kHz to heal fracture. The calf muscles were exposed with focused ultrasound for four days. Micro-computed tomography was used to evaluate the effects in Trabecular bone. The outcomes were significant and suggested that focused pulsed ultrasound can be used to eleviate paralysis-induced bone loss (Poliachik, Khokhlova, Wang, Simon, & Bailey, 2014).

Vibrations do have effects on organs and physiological systems. To study these effects, an experiment was conducted by employing rat models. Two groups were assigned for this study, one was control and in the other group, the tails of the rats were exposed to sinusoidal vibration at 250 Hz, 49 m/s2 for ten days daily for 4 h. The outcomes explained the fact that organs and physiological systems are affected by vibrations regardless of direct exposure in a way that the function of autonomic nervous system may vary, or there maybe any inflammation or oxidative stress (Krajnak & Waugh, 2018). In a similar study, the ventral tail artery of rats was exposed to vibration at 62.5, 125, or 250 Hz (constant acceleration of 49 m/s2) to study the influence on the inflammation, oxidative stress, vascular morphology and gene expression also. The exposure of vibration led to the vascular remodeling. The luminal diameters decreased, while an increase in the thickness in the VSM arteries was observed. The rats which were exposed to 250 Hz vibration showed significant changes (Krajnak et al., 2010).

CONCLUSION AND FUTURE ASPECTS:

Focused ultrasonography has been accepted in many developed countries like Canada, Europe, Korea, Israel, and Russia for the treatment of Parkinson's disease, neuropathic pain and essential tremors. This technique even enables brain tumors treatment without the need for an incision or radiation. Focused ultrasonography is reshaping the therapeutic methods currently used and is preferred over conventional methods of treatment since it provides minimum discomfort, lesser complications, and quick recovery. FUS has a promising future in the therapeutic world and it will be soon integrated into clinical practices around the world. Despite the great results of FUS in clinical trials, there is still a lot of progress; advancement and literature are required to make it a secure and feasible treatment of choice in curing various diseases.

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