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ACOUSTIC/MAGNETIC FIELD ASSISTED PERFUSION STUDY

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Abstract – This pilot investigation assessed the effectiveness of an acoustic device combined with a dynamic magnetic field to increase perfusion in areas of application. The device, a Cyma 1000, delivered five acoustic frequencies 900- 1300 Hz chosen for arterial support. The magnetic coil oscillates at the same frequencies as the acoustic wave. A control group was chosen having normal perfusive ability, a second group was chosen to test the applicator's ability to assist perfusion across a range of pathological conditions. Thermography was used to view perfusion before and after application. Both groups and all cases studied showed application improved perfusion.

Introduction

Adequate blood supply is vital to the health of all cells and organ systems and essential for sustaining life. The function of the circulatory system is to deliver oxygen and nutrients to all cells. It also removes carbon dioxide and waste products maintaining optimal tissue pH. Without viable perfusion, organ systems suffer; the sequeli of ischemic cascade and cellular degradation ensues, thus life ends. Within tissue, lack of oxygen causes a neuron's normal process for making ATP for energy to fail. The cell switches to anaerobic metabolism, producing lactic acid. ATP-reliant ion transport pumps fail, causing the cell to depolarize allowing ions, including calcium ion (Ca++), to flow into the cell. The ion pumps can no longer transport calcium out of the cell, and intracellular calcium levels get too high. Calcium triggers the release of the excitatory amino acid neurotransmitter glutamate. Glutamate stimulates AMPA receptors and Ca++-permeable NMDA receptors, which open to let more calcium into cells. Excess calcium entry overexcites cells and causes generation of harmful chemicals like free radicals, reactive oxygen species and calcium-dependent enzymes such as calpain, endonucleases, ATPases, and phospholipases in a process called excitotoxicity. Calcium can also cause the release of more glutamate. As the cell's membrane is broken down by phospholipases, it becomes more permeable, and more ions and harmful chemicals flow into the cell. Mitochondria break down, releasing toxins and apoptotic factors into the cell. The caspase-dependent apoptosis cascade is initiated, causing cells to 'commit suicide.' If the cell dies through necrosis, it releases glutamate and toxic chemicals into the environment around it. Toxins poison nearby neurons, and glutamate can overexcite them. If tissue is reperfused, a number of factors lead to reperfusion injury. An inflammatory response is mounted, and phagocytic cells engulf damaged, but still viable tissue. Harmful chemicals damage the tissue. Edema occurs due to leakage of large molecules like albumin from blood vessels through the damaged tissue. These large molecules pull water into the tissue after them by osmosis. This 'vasogenic edema' causes compression of and damage to tissue. Since oxygen is mainly bound to hemoglobin in red blood cells, insufficient blood supply causes tissue to become hypoxic, or, if no oxygen is supplied at all, anoxic. This can cause necrosis (i.e. cell death). When perfusion is impeded, the eschemic cascade ensues within seconds to minutes, necrosis due to ischemia usually takes about 10-12 hours.[1-4].

Over the past decade a number of studies have been performed to investigate the therapeutic use of magnetic fields to mitigate against ischemic cascade while it is occuring and to repair tissues damaged following reperfusion [5-6]. A biological mechanism behind the efficacy of the magentic field in these cases may lie in the recent mathematical developments in understanding the self fields of the hydrogen atom [7-8]. Self field theory gives actual dynamics of the sub-atomic particles in contrast to probabilistic results of quantum mechanics. When a magnetic field is applied, the electron inside the atom does not change its orbital speed but rather its cyclotron speed, its spin, is increased. Like the gyroscopic ability well-known in ballistic design to keep projectiles on track and thus increase their effective range, the magnetic field may increase the ability of atoms and molecules to ward off unwanted randomly directed electric fields in the arterial milieu due to the ischemic cascade reactions described above. As for the acoustic fields, Bauer and Fleming have previously presented results from another pilot study using the Cyma 1000's acoustic fields without the dynamic magnetic field to promote repair of a tendon in a thoroughbred racehorse [9]. The goal of this preliminary investigation, using thermography as an indicator, was to examine the value of the frequencies specific to supporting increased arterial flow to areas where acoustic fields combined with the dynamic magnetic fields were applied.

Method

After obtaining and reviewing a detailed medical health history and a medical examination; a random control group of 10 subjects, aged 25 to 65, without underlying vascular pathology, was selected. Baseline thermographs were obtained before any intervention. After evaluating the baseline thermographs, the acoustic device (Cyma 1000) was used to deliver specific audible frequencies that ranged from 900 to 1300 Hz. In the normal control group these frequencies were administered for 10 minutes to both forearms in supination, an area from the wrist to the elbow with palm side up. Following the successful results of the random control group it was decided that a further experimental group showing vascular compromise should be studied. The vascularly compromised experimental group studied included those with pulmonary diseases and peripheral vascular disease. In the experimental groups, after medical histories, exams and baseline thermographs were obtained, the frequencies were applied for 10 minutes to the areas of pathology. Informed consent was obtained from each subject before their participation in this investigation.

Results

Control Group: Thermographic Results

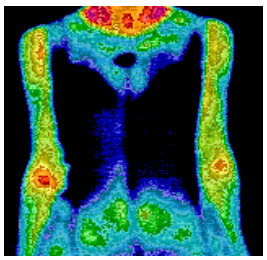


Fig. 1a. Before

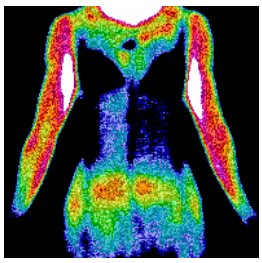


Fig 1b. After

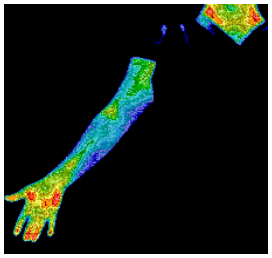


Fig. 2a. Before

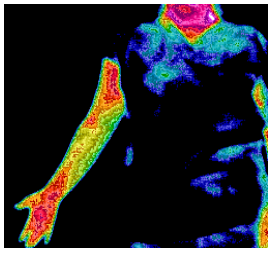


Fig 2b. After

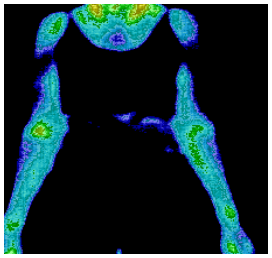


Fig. 3a. Before

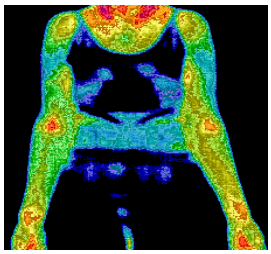


Fig 3b. After

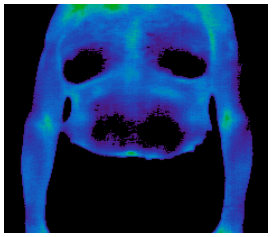


Fig. 4a. Before

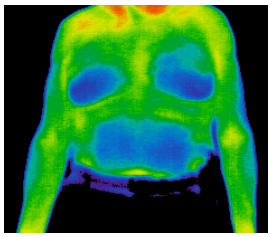


Fig. 4b. After

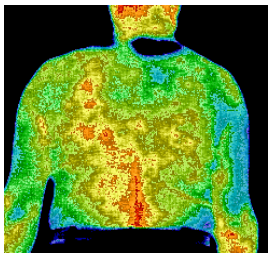


Fig. 5a. Before

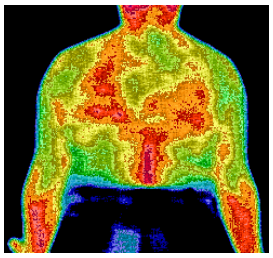


Fig. 5b. After

Experimental Group Thermographic Results: Pulmonary Diseases

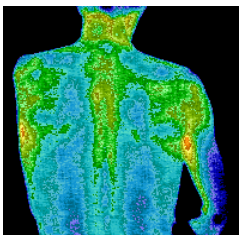


Fig. 6a. Emphysema: Before

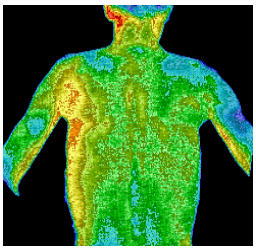


Fig. 6b. Emphysema: After

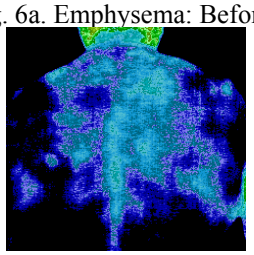


Fig. 7a: Pulmonary Fibrosis: Before

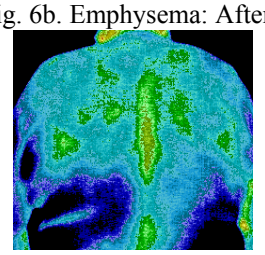
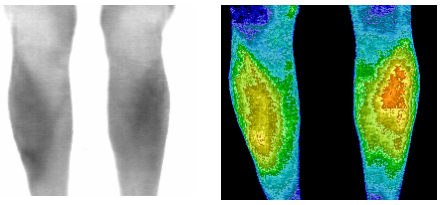
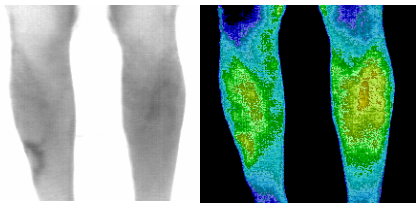


Fig. 7b. Pulmonary Fibrosis: After

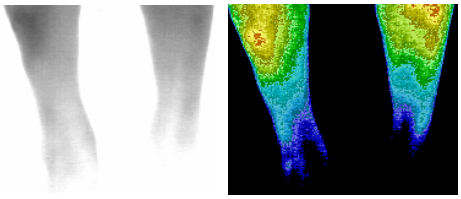
Experimental Group Thermographic Results: Inflammatory Peripheral Vascular Disease



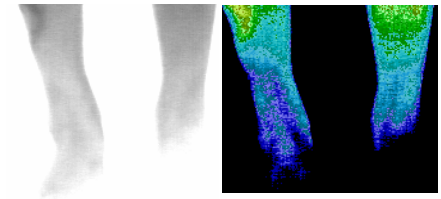
Figs. 8a and 8b. Legs before



Figs. 8c and 8d. Legs after



Figs. 9a and 9b. Feet before



Figs. 9c and 9d. Feet after

The results of the preliminary investigation were very positive, showing consistently improved perfusion across thermographs after application. Improvements in perfusion were shown across the control group as can be seen in the follow-up thermographs compared to baseline thermographs. Clinically for the cases shown in Figs. 6b and 7b there was a marked increase in SpO_2 and marked improvements in breath sounds, anxiety levels, and respiratory effort as compared to baseline. The subjects reported that they were able to inhale more easily as well as exhale without the usual feeling of restriction. For the cases shown in Figs. 8c, 8d, 9c and 9d. a marked decrease in inflammation occurred and an increase in perfusion compared to baseline images 8a, 8b, 9a and 9b. Before the application of this acoustic device pedal and post-tibial pulses were not palpable; after the application of this acoustic device pedal pulses were palpable, bilaterally.

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