MagnoPro Magnetic System and Stress Management: a before and after comparison to another magnetic therapy system and controls

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The very presence of life means that stress is also present. The recognition of and the reaction to stressors is fundamental to physical and emotional existence. Our reactions to stressors are either healthy, that is, adaptive, or unhealthy, that is, maladaptive. Maladaptive reactions to stress create physical and psychological damage, if either too large to withstand or too frequent to recover from. Chronic maladaptive responses to stress, by virtue of their legion effects on the body and all its organs, accelerate the aging process and cause many of modern civilization's illnesses.

Some of the physiologic reactions to stress are: muscle tension, rapid heartbeat, sweaty palms, diarrhea or constipation, increased gastric acid, high blood pressure, increased adrenal hormones (ACTH), exaggerated mental alertness, increased blood sugar, increased blood lipids, dry mouth, increased insulin, increased thyroid hormone and immune changes.

The physical problems that can result from stress are: insomnia, nervous irritability, headaches, arteriosclerosis, hypertension, irritable bowel, gastritis, arrhythmias, panic attacks, anxiety, depression, fatigue, substance abuse, immune deficiencies, asthma, skin problems, allergies, muscle spasms, neuralgias, vision changes, hyperventilation, dehydration, sudden cardiac death, vasospasm, increased cholesterol, increased platelets, decreased oxygen, appetite problems, accelerated auto immune problems increased actually, miscarriages decreased libido, impotence, menstrual changes, disturbed memory, among others.

A new, simple, easily useable approach to reducing the physical response to the effects of daily stress is the use of whole body pulsed magnetic fields (PEMF).

The body is very sensitive to magnetic fields (MFs). The Earth is a large magnet. We are also bombarded by electromagnetic activity from outside the planet. Physiologic changes are seen during solar storms in healthy humans, in patients with cardiovascular diseases and in cosmonauts in SOYUZ spacecraft and the MIR space station (5). They had nonspecific adaptive stress reactions, with increased cortisone secretion and activation of the sympathoadrenal system (SAS) and suppressed production of melatonin.

There is much experimental evidence that almost all biological systems are highly sensitive to weak generated PEMFs, with a wide range of biologic effects.

Since human experimentation is often not possible, much work has been done in animals. Research, on humans and animals, has shown that PEMFs alter stress responses by action directly on the nervous system, cells, tissues and organs.

Since most stress responses are mediated through the sympathetic-adrenal system (SAS), if PEMFs can blunt or reduce this maladaptive physical stress response, this would be an important, simple approach to managing chronic lifetime stress. Research has shown that PEMFs inhibit activation of the sympathetic-adrenal system (SAS) and prevent a decrease in nonspecific stress resistance (6).
PEMFs do this by acting on the hypothalamus and increasing urine excretion of adrenalin. Long-term use of weak PEMFs may be able to help the body remodel tissues that tend to be hyper-reactive to chronic or acute stress so that over time they will be less reactive.

PEMFs can be used preventively prior to anticipated heat, toxicity or surgical injury to prevent cellular harm and thus increase cellular stress resistance and reduce cellular stress responses, by increasing stress proteins in the cells. Exposure of endocrine glands and control centers of the nervous system to PEMFs triggers the broader natural control processes of homeostasis (9).

Stress causes a very quick and significant decrease in white blood cell counts, creating a sudden state of immune vulnerability. It also increases serum cortisol two to three-fold, a useful indicator of the level of stress. PEMFs modulate host resistance (4) by enhancing some immune functions. After exposure, neutrophils increase gradually and neutrophil metabolism and superoxide production are increased significantly. The cortisol level decreases. Ascorbic acid (AA) is key to the antioxidant, neuroendocrine and immune mechanisms of stress adaptation (34). PEMFs cause ascorbic acid and serotonin to increase nearly two-fold.

In athletes (1), PEMF therapy using decimeter waves (DMW) on the adrenal glands, thyroid gland or collarbone areas augmented immune status and production of hormones, specifically, T-lymphocytes, testosterone and growth hormone, and decreased circulating B-lymphocytes, cortisol and initially elevated levels of thyroid hormones. The athletes therefore had higher resistance to disease and higher work capacity.

MFs act on rabbit sinocarotid baroreceptors to reduce blood pressure by causing vasodilation and lowering heart rate (3). The stimulated baroreceptors reset sympathetic tone. In humans, MFs over the right and left carotid sinuses, also improved Heart Rate Variability (2).

PEMFs result in the several apparently related long-lasting localized effects, that mitigate stress: an increase in blood volume, increase in oxygen partial pressure (pO^2), increased pH (reduced acidity), increased depth of respiration, decreased heart rate and improved blood pressure (7). The magnitude of these effects in humans showed significant inter-individual variability. They appear to be caused by lowered blood acidity, as indicated by measurements of lactic acid and pyruvic acid concentration, carbon dioxide partial pressure (pCO^2), and hydrogen ion (H^+) concentration. PEMF effects would be increased during periods of high muscle activity, after drinking alcohol, while sleeping, or after inhaling carbon dioxide. Conditions that promoted alkalosis such as hyperventilation and eating large meals could be expected to reduce the magnitude of the effects.

Extremely low-frequency (ELF) PEMFs affect blood vessels. Head and chest exposure to ELF PEMFs induced dilation of the larger blood vessels in these areas and increased pO^2 (8). PEMFs having a variety of pulse shapes, amplitudes, and repetition rates applied to the neck of human volunteers altered the respiration cycle, heart rate, blood pressure, and vessel perfusion. These effects showed wide variability and poor reproducibility.

The purpose of this study was to examine whether a new broadband PEMF device, the MagnoPro would be able to improve several specific physiologic parameters indicative of stress in pain patients in an acupuncture practice. The physiologic parameters to be tested were: blood pressure, heart rate, fingertip oxygen levels and salivary cortisol levels. In stress states, and chronic pain is a major stress condition. Blood pressure, heart rate and cortisol levels tend to increase and tissue oxygenation decreases.

METHODS

There were 3 groups selected for the study, a treatment group using the OMT Magnopro device, a treatment group using the QRS from Magnovit and a non-treatment control group.

For the OMT group clients were selected randomly from a list of about 340 patients of an acupuncture office. An office assistant called the patients to let them know that the investigator would be doing a clinical trial and asked them if they would be interested in participating.

They were told that the study would test the effects of a new technology on stress biomarkers and had to be 18 years of age or older. If they had interest at that point, they were scheduled for an appointment for a consultation to learn more about the study. After the consultation it was determined, who would have availability to actually enter the study. From these interviews 24 people agreed to enter the study. Due to inherent study size restrictions, only the first 15 people who were interviewed and available to come in within the next month in July or August of 2002 were sequentially selected. The final groups were between 18 and 75 years of age. There were 6 females and 9 males.

The other two groups were convenience samples chosen from similarly invited patients, offered to participate in the study and accepted sequentially until the selected number of subjects was achieved, i.e., 15 for the study group and 20 in each of the other two groups.

The OMT was set at Program 4, intensity level 6 and the QRS was set at Basis 1. The non-treatment control group lay on a regular acupuncture table

The room for the study was a clean room as far as the magnetic fields present was minimized, i.e. only the ambient geomagnetic field of Seattle, Washington, USA, was present. All AC and DC appliances were removed except for the control unit of the magnetic system. Appliances in the adjoining room rooms were turned off for the study.

When the subjects came into the study exam room, they had a basic introduction to the protocol; salivary sample was collected for cortisol in the OMT group only before the rest of the study began for baseline purposes. All groups also had systolic and diastolic blood pressure, heart rate and pulse oximetry tested at baseline. Blood pressure was measured with a manual mercury sphygmomanometer and the same office nurse recorded pulse manually. After the baseline tests were conducted, the study subjects were exposed for 20 minutes to the respective magnetic field system to the whole body or on the acupuncture table, laying supine. The magnetic systems consisted of a control unit and a thin mattress pad with a coil inside to generate the magnetic field.

Immediately after the magnetic field exposure, the clients were retested with the same tests. The clients were then discharged and informed that they would be given copies of the research results. These test subjects were not awarded any compensation for their participation. They were generally long-standing pain patients of the practice and had confidence in the work being performed.

The magnetic field device converts existing line AC into DC and pulses the frequencies through the coil. The OMT-2000-H produces maximum field strength of 24 microTesla. The frequencies produced in a constantly repetitive cycling pattern include: 2-32Hz, 200 Hz, 250 Hz, 300 Hz, 400 Hz, 900 Hz, 1000 Hz and 1100 Hz, using a saw-tooth wave. The control unit, which can be set for various time frames, was set for exposure duration of 20 minutes for this study.

The QRS also has a broadband signal, with maximum field strength of 30 microTesla. The frequencies are produced in a constantly repetitive cycling pattern include: 3 Hz, 23 Hz, 250 Hz, and 500 Hz, using a saw-tooth wave. The control unit, which can be set for various time frames, was set for exposure duration of 20 minutes for this study.

Analysis was with the Student's T test for paired samples for the within groups before and after measurements. A T test for comparison of means assuming unequal variances was used for the between groups comparisons for the OMT vs. QRS, OMT vs. non-treatment control and the QRS vs. non-treatment control conditions.

RESULTS

Group	Measure	Systolic		Diastolic		SpO2		HR	
		Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
NoRX Control	**Mean**	130.5	131.6	84.8	85.05	96.05	95.9	71.9	72.45
	p<	0.20		0.73		0.51		0.45	
QRS	**Mean**	133.25	130.75	86.30	82.90	95.90	95.95	73.05	71.15
	p<	0.02		0.00005		0.0096		0.39	
OMT	**Mean**	136.53	131.13	82.33	80.53	95.73	96.73	75.53	72.47
	p<	0.002		0.23		0.02		0.11	

Pre and Post Differences	**Measure**	**Systolic**	**Diastolic**	**SpO2**	**HR**
OMT	**Mean**	5.4	1.8	1	3.07
QRS	**Mean**	2.5	3.4	0.05	1.9
NoRx Control	**Mean**	-1.10	-0.25	0.15	-0.55
OMT vs NoRx Control	**p<**	0.002	0.24	0.03	0.12
OMT vs QRS	**p<**	0.08	0.13	0.005	0.3
QRS vs NoRx Control	**p<**	0.02	0.0003	0.72	0.02

Intragroup Comparisons

a) Experimental OMT Group

Pre-treatment values of blood pressure (systolic and diastolic), oxygen saturation, heart rate and salivary cortisol levels were compared to post-treatment values for 15 experimental patients.

Data are summarized in tables 1 and 2 following.

Table 1 Pre and post-test measure means for the experimental OMT group

Test	**Pre Test**	**Post Test**	**Significance**
Systolic BP	136.5	131.1	* p<0.006
Diastolic BP	82.3	80.5	* p>0.05
Heart Rate	75.5	72.5	* p<0.02
Cortisol	9.07	6.65	* p<0.006
Oxygen Saturation	95.7	96.7	* p<0.004

The 15 subjects showed statistically significant differences pre-treatment to post-treatment for systolic blood pressure (lower post-treatment), oxygen saturation (higher post-treatment), and salivary cortisol (significantly lower post-treatment). The blood pressure changes were only significant for the systolic pressure. Although they weren't significant for the diastolic pressure they were still lower in the post-test period.

b) QRS Group

Table 2 Pre and post-test measure means for the comparison magnetic system group

Test	**Pre Test**	**Post Test**	**Significance**
Systolic BP	133.25	130.75	*p<0.02
Diastolic BP	86.3	82.9	*p<0.00005
Heart Rate	73.05	71.15	*p<0.0096
Oxygen Saturation	95.9	95.95	p<0.39

The 20 subjects showed statistically significant differences pre-treatment to post-treatment for systolic and diastolic blood pressure (lower post-treatment) and heart rate (lower post-treatment). Oxygen saturation was largely unaffected.

c) Non-treated Control Group

Table 3 Pre and post-test measure means for the Non-treated Control group

Test	**Pre Test**	**Post Test**	**Significance**
Systolic BP	130.5	131.6	p<0.2
Diastolic BP	84.8	85.05	p<0.73
Heart Rate	71.9	72.5	p<0.45
Oxygen Saturation	96.1	95.9	p<0.51

The 20 non-treatment control subjects showed no statistically significant changes pre and post resting on the acupuncture table. If anything there were very slight increases after relaxation.

Intergroup Comparisons

The test measure values were subtracted, post-test from pre-test, to obtain the treatment effect difference. These subtracted values were then compared between the experimental OMT and the two control groups and between the two control groups.

Pre and Post Differences	**Measure**	**Systolic**	**Diastolic**	**SpO2**	**HR**
OMT	**Mean**	5.4	1.8	1	3.07
QRS	**Mean**	2.5	3.4	0.05	1.9

NoRx Control	**Mean**	-1.10	-0.25	0.15	-0.55
OMT vs NoRx Control	**p<**	0.002	0.24	0.03	0.12
OMT vs QRS	**p<**	0.08	0.13	0.005	0.3
QRS vs NoRx Control	**p<**	0.02	0.0003	0.72	0.02

Systolic blood pressure showed the biggest improvement in the experimental OMT group and the QRS group vs. the non-treatment control group. When the OMT was compared to the QRS there was an advantage for the OMT but only significant at the $p<0.08$ level. Diastolic blood pressure showed a significant advantage for the QRS only and a minor trend toward improvement for the OMT. Oxygen saturation, a measure that is assumed to be less subject to a relaxation effect, showed more improvement in the experimental OMT group than in the two control groups. Heart rate showed a very similar pattern to systolic blood pressure but only reached significance in the QRS vs. the non-treatment control group.

For the test parameters that were not significant, subtest analysis in the OMT group, evaluating for levels of blood pressures, heart rate, cortisol and oxygen saturations, from normal to mildly elevated to moderately to significantly elevated, indicates that the largest changes happened in the sub-groups with the greatest departures from normal values. This means that those individuals with the highest blood pressures, fastest heart rates and lowest oxygen saturations had the greatest improvement with OMT MagnoPro stimulation. The small numbers of subjects in each of the subgroups do not allow for statistical analysis, however.

DISCUSSION

The results of stimulation with the Magnopro H system versus an unmatched, unblinded, non-randomized (to the investigator) and non-treated control group and versus the QRS system, indicate that there is a significant “treatment” effect, whether active or unstimulated control exposure. Systolic blood pressure and heart rate were significantly different between magnetically treated and the non-treatment control group subjects. There was almost no “relaxation effect” benefit. Diastolic pressure is more sensitive to the QRS for unknown reasons. This suggests that the OMT is more sympathetically active and the QRS is more parasympathetic. A trend to improve these measures of stress is seen even if non-significant statistically. However, the magnetic field exposure with the OMT appears to be much more significantly, even in this small study sample, improve peripheral tissue oxygen saturation. While the change in tissue oxygen levels might be mediated by changes in vascular tone, these vascular tone effects are not large enough to significantly affect blood pressure and heart rate. This suggests a more local vascular effect and/or enhanced cellular tissue absorption.

Further, even though for practical purposes the salivary cortisols were not repeated in the controls, they appear to decline with treatment as well with the OMT, indicating a reduction in stress response. Again, a trend difference was detected in those with higher levels to begin with, lending some additional credence to a stress reduction effect of magnetic field stimulation with the MagnoPro system.

It further points to the possibility that a “broader band” signal system has a stronger physiologic response, in this very limited exposure protocol setting. The OMT appears to also have stronger field strength and this combined with an expanded number of signals may account for these differences.

It is somewhat surprising that there was little “relaxation response” in this study overall.

It goes without saying that this pilot level, small non-randomized and non-blinded control study, in a pain patient population, needs to be replicated with a larger randomized trial to validate the observations noted above.

SUMMARY

This study suggests that the OMT Magnopro magnetic therapy system is useful for reducing stress responses or inducing a relaxation response, in particular for systolically sensitive individuals and also to improve tissue oxygenation. The QRS in these circumstances appears to be more useful for diastolically sensitive or affected individuals, perhaps preferential for the chronic stress-prone.

REFERENCES

1. Gigineishvili, G. R.; Dombrovskaya, I. I.; Belousov, A. Yu.; Kirova, E. I.; Orekhova, E. M.; Radzievskii, S. A.; Liubimskaya, L. I. Use of physical therapy for faster restoration and increasing of working capacity in sportsmen. Vopr Kurortol Fizioter Lech Fiz Kult (5):2530, 1995.
2. Gmitrov, J. Static magnetic field effect on sinocarotid baroreceptors in humans. Electro Magnetobiol 15(3):183-189, 1996.
3. Gmitrov, J.; Ohkubo, C.; Yamada, S.; Gmitrova, A.; Xu, S. Static magnetic field effects on sinocarotid baroreceptors in rabbits exposed under conscious conditions. Electro Magnetobiol 14(3):217-228, 1995.
4. Isaeva, E. N.; Fomicheva, E. E.; Pivanovich, I. Yu.; Nemirovich-Danchenko, E. A.; Korneva, E. A.; Barnes, F. S. Effect of electromagnetic fields exposure on stress-induced neutrophils activity changes. Bioelectromagnetics Society, 22nd Annual Meeting, 11-16 June, Munich, Germany, 2000.
5. Rapoport, S. I.; Boldypakova, T. D.; Malinovskaia, N. K.; Oraevskii, V. N.; Meshcheriakova, S. A.; Breus, T. K.; Sosnovskii, A. M. Magnetic storms as a stress factor. Biophysics 43(4):596-602 Biofizika 43(4):632-639, 1998.
6. Temur'iants, N. A.; Mikhailov, A. V.; Maligina, V. I.; Tishkin, O. O.; Nasilevitch, V. A.; Kaminina, I. B. Antistressor effects of weak variable magnetic fields. Bioelectromagnetics Society, 20th Annual Meeting, 7-11 June, St. Pete Beach, FL.

7. Warnke, U. ELF-pulsating magnetic field (pmf)- induced adequate stimulation of baroreceptors. Hungarian Symposium on Magnetotherapy, 2nd symposium, Szekesfehervar, Hungary, 1987.
8. Warnke, U. Survey of some working mechanisms of pulsating electromagnetic fields (PEMF). Bioelectrochem Bioenerg 27(3):317-320, 1992.
9. Zubkova, S. M. Adaptive changes in the body upon exposure to electromagnetic radiation. Biofizika 41(4):917-922, 1996.