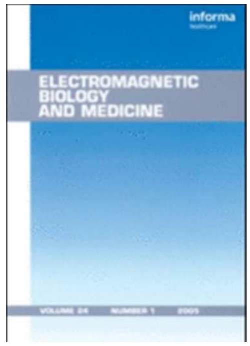

EMOST: Elimination of chronic constipation and diarrhoea by low-frequency and intensity electromagnetic fields

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Abstract

Previously, we reported about the effectiveness of the EMOST (Electro-Magnetic-Own-Signal-Treatment) treatments in reduction of phantom limb pain as well as improvement of the quality of sleep and mood in subjects under clinical circumstances. We also presented the successful application of EMOST for mental stress management of humans under catastrophic conditions. Our some years experience indicated that the efficiency of EMOST is much greater in children than in adult subjects. In addition, in children much less treatment is needed for recovery compared to adult subjects, as well as the duration of the treatment is shorter. It is possible that this particular success is due to the large plasticity of the central and the autonomic nervous system in young patients. Thus, our research pays special attention regarding the EMOST effectiveness in the field of chronic childhood diseases. Here we report about results of routine alternative treatments carried out at Biolabor Biophysics and Laboratory Services Ltd by EMOST device regarding to the elimination of chronic constipation and persistent diarrhoea in the case of two children. We also briefly present two important possible biological mechanisms such as redox processes and the bidirectional communication between skin cells and the nervous system regarding the efficiency of low-frequency and intensity electromagnetic fields (LFI-EMF) treatments.

Keywords: Chronic diarrhoea, Chronic constipation, Low-frequency and intensity electromagnetic fields (LFI-EMFs)

Introduction

Living cells produce a particularly weak non-linear electromagnetic activity in a wide spectrum of frequencies - from Hz to THz (Fraser and Frey, 1968; Isojima et al., 1995; Cohen and Popp, 1997; Kobayashi et al., 1999; Pokorný et al., 2001; Lipkova and Cechak, 2005; Cifra et al., 2011; Albrecht-Buehler, 2005; Wang, Bókkon et al., 2011) that is due to the various cellular mechanisms associated with biochemical/ bioelectric processes.

Although modern pharmacology has made considerable progress in the treatments of diverse diseases, we should also recognize that in many cases pharmacology treatments can be ineffective. In these cases, the application of biophysical low-frequency and intensity electromagnetic fields (LFI-EMFs) could offer new opportunities, because during various diseases, cells not only display altered biochemical processes but also generate altered non-linear bioelectric and bioelectromagnetic complex patterns.

To date, most investigations about electromagnetic exposition focus for the harmful effects that are due to the increased environmental artificial electromagnetic pollutions (especially microwaves and radiofrequencies, among others) (Viel et al., 2009; Abdus-salam et al., 2008; Hardell and Sage, 2008). However, several increasing evidences revealed that non-ionizing LFI-EMFs influence cell functions and can facilitate or initiating various healing processes, such as the delay of fractures, induction of analgesia, acceleration of wound re-epithelialization, inhibition of inflammatory processes, reduction of fatigue, improvement of multiple sclerosis and chronic pulmonary disease, among others (Orgel et al., 1984; Sandyk, 1996; Selvam, et al., 2007; Satter Syed et al., 1999; Lappin et al., 2003; Kumar et al., 2005; Alfieri et al.. 2006; Zhang et al.. 2007; Markov. 2007a; Tsang et al.. 2009; Mach and Persinger, 2009; Mancuso et al., 2007; Patruno et al., 2010).

We should make difference between the harmful effects of environmental electromagnetic pollutions from the possible application LFI-EMFs for therapies. The former is an uncontrolled harmful process but later is controlled procedure with specific electromagnetic frequencies, durations and wave forms.

In addition, the role of exposure time during LFI-EMF therapies is extremely critical (Di Carlo et al., 2002; Regoli et al., 2005). LFI-EMF radiations with a short-term exposition (about less than 45 min) can facilitate the immune system and cellular processes, but a long-term or continuous exposure to LFI-EMFs results in a decline in cytoprotection (Regoli et al. 2005; Di Carlo et al. 2002). Long-term electromagnetic exposition can shift the redox and calcium balance, which could cause additional cellular malfunctions. For example, NMDA receptors can be redox modulated by hydroxyl radicals (Aizenman, 1995; Bókkon and Antal, 2011), but long-term or continuous exposure to LFI-EMFs provoke aberrant NMDA receptor activities (Manikonda et al., 2007).

Here we report about the elimination of chronic constipation and persistent diarrhoea by LFI-EMF treatments by EMOST medical device (Figure 1) in the case of two children. We also briefly propose two important possible mechanisms such as redox processes and the bidirectional communication between skin cells and the nervous system regarding the efficiency of LFI-EMF treatments.

Chronic diarrhoea

Chronic diarrhoea (duration > 14 days or longer) is very complex symptom that is due to a wide range of aetiologies. Usually, there is more than one mechanism can be occurring simultaneously. Acute diarrhoea disorders usually due to the: I. Infections (bacterial as Salmonella, Shigella, Clostridium, and Yersinia or viral as Rotavirus, Adenovirus, Cytomegalovirus, and Human immunodeficiency virus *(*HIV)); II. Drugs (like antibiotics) or poisons; III. Immediate hypersensitivity reactions (Thapar and Sanderson, 2004).

Chronic diarrhoea can be produced by: I. Parasite infections (Giardia, Entamoeba, Cryptosoridia, etc.); II. Congenital disorders of digestion or absorption (cystic fibrosis, autoimmune disorders, enzyme defects, food allergies, among others). Irritable bowel syndrome (IBS) is one of the most common causes of chronic diarrhoea. Diabetes can also induce chronic diarrhoea when the nerves that supply the digestive tract are injured (Thapar and Sanderson, 2004).

Chronic diarrhea can make severe complications such as malnutrition, dehydration or weight loss. In addition, persistent diarrhoea is related to undernutrition, growth faltering, micronutrient deficiency, impeded neurodevelopment, increased morbidity and mortality in childhood, among others (Moore et al., 2010; Black et al., 2008; McAuliffe et al., 1986). The goal of chronic diarrhoea management is to eliminate the underlying cause. For example, diarrhea produced by infections can be treated with antibiotics (Schorling et al., 1991). In other cases, management is simple eliminating a food (like in the case of lactose intolerance) or drug. However, in several cases, the cause of chronic diarrhoea is unknown.

Chronic Constipation

Constipation is a frequent gastrointestinal disorder in the pediatric (Borowitz et al., 2003; Youssef and Di Lorenzo, 2001) as well as in adult population (Drossman et al., 1993; Higgins and Johanson, 2004) that affects mostly women. Mild constipation can be defined as fewer than three stools per week and severe constipation as less than one stool per week. Constipation usually is caused by the slow movement of stool through the colon. In most cases chronic constipation has not any dietary or structural causes that can be revealed. Chronic constipation negatively affects the quality of life and produce high costs (Spinzi et al., 2009; Martin et al., 2006). Constipation requires an urgent assessment if it is accompanied by symptoms such as rectal bleeding, abdominal pain and cramps, nausea and vomiting, and involuntary loss of weight. Causes of functional constipation include, for example, dehydration, inflammatory bowel disease, psychosocial stress, parental disharmony, etc.

Regarding to nonpharmacologic strategies there is not any evidence, for example, that increased exercise and fluid intake could provide relief the symptoms of chronic constipation (Müller-Lissner et al., 2005). Nonpharmacologic biofeedback retraining of the pelvic floor for treatment of defecation provided effectiveness (Koh et al., 2008) but additional studies are needed in the future. Other managements of constipation can include dietary fiber, non-stimulant laxatives (osmotic laxatives such as saline laxatives, nonabsorbed sugars or polyethylene glycol thatcan increase intestinal water secretion) or stimulant laxatives (diphenylmethane or anthraquinone derivates), enemas, surgery, among others (Coremans, 2008). Stimulant laxatives should not be used more than a few days because they can permanently damage the colon and worsen constipation.

EMOST method and natural-based electromagnetic signal forms

EMOST medical device (Figure 1) can detect non-linear bioelectric and bioelectromagnetic signals from subjects' skin by special input/output electrodes. The collected signals are processed by computer of EMOST device. The subjects are treated by processed signals originated from device (frequency range between 1 Hz - 1 MHz; intensity range between 0.1-10 micro Tesla). A particular feature of EMOST method - compared to most of electromagnetic equipments - is that the subjects' own bioelectromagnetic signals that are detected from skin can be processed in analogue mode (non-digitalized). Then, analogue signals are radiated back using a flat electrode radiator through various band/signal combinations, with some amplification (-20dB- +60dB), to the skin's surface on the opposite side and extended by the higher range sounds of the signal. The special analogous process makes it possible that the biophysical information content of detected and back-transmitted electromagnetic signal is much larger than in digitized methods (Figure 1).

Fig. 1. EMOST Redox 1.1. Medical Device (Certificate: HU11/6192) controlled by a personal computer.

Stimuli by artificial electric and electromagnetic signal forms do not contain natural information originated from our body (Figure 2). In contrast, detected own signals include information, for example, from the nervous system, muscle activity or from any element of coordination. The electroencephalogram (EEG) or the electrocardiogram (ECG) of cardiac function include information-rich, nonlinear and natural signals, so, these are typically own signals, which are originated from the subject, and they are not only continuous variable, but also are individual. It is reasonable to propose that the special efficiency of EMOST is due to the application of information-rich, nonlinear and natural-based signals from our body.

Fig. 2. Illustration about information-rich, natural (nonlinear) electroencephalogram signal, and artificial sinus and square signal forms.

Regarding to EMOST method, recently, we reported about the effectiveness of the EMOST treatments in reduction of phantom limb pain as well as improvement of the quality of sleep and mood in patients under clinical circumstances (Bókkon et al., 2010, 2011a, 2011b). We also presented the successful application of EMOST for stress management of humans under catastrophic conditions (Bókkon et al., 2012). Some preliminary experiments on twelve members of our BioLabor Ltd. regarding the effectiveness of single EMOST treatment on some serum parameters were also shown (Bókkon et al., 2012).

Our some years experience with EMOST revealed that in children much less management was needed for recovery compared to adult subjects, as well as the duration of the treatments were shorter (about with an average of 25 minutes compared to adult subjects with an average of 45 minutes). It is probable that this special effectiveness of EMOST treatments is due to the large plasticity of the central and the autonomic nervous system in young patients. Thus, our research pays special attention to study EMOST effectiveness in the field of (chronic) childhood diseases.

Possible mechanisms for spreading low frequency and low intensity electromagnetic signals in the body

Numerous hypotheses have been suggested to elucidate the influence of LFI-EMFs in living systems. For example, Eddy electric currents, resonance models, biomagnetites, the interference of quantum states of bound ions and electrons, coherent quantum excitations, stochastic and parametric resonance, and magnetosensitive free-radical processes, among others (Binhi, 1999; Bókkon and Salari, 2010). Despite these notions, the major effect of LFI-EMFs on cell functions remains unclear. It is reasonable to propose that more mechanisms act simultaneously on cellular systems under LFI-EMF expositions. However, here we emphasize and briefly present two important possible biological mechanisms such as redox processes and the bidirectional communication between skin cells and the nervous system regarding the efficiency of LFI-EMF treatments.

Redox regulation and LFI-EMF signals

Latest experiments have provided evidence that free radicals and their derivatives (redox regulation) act as essential signals (secondary messengers) during physiological (and pathophysiological) processes in intra- and intercellular signaling processes (Hidalgo et al., 2000; Hancock et al., 2001; Dröge, 2002; Turpaev, 2002; Fang et al., 2004; Ushio-Fukai and Alexander, 2004; Zhang and Gutterman, 2007; Kamsler and Segal, 2007; Valko et al., 2007; Kishida and Klann, 2007; Bókkon and Antal, 2011). Because several effects of LFI-EMFs can be explained by redox regulation and membrane processes, LFI-EMFs may have an important effect on redox mechanisms. According to the latest results of Morabito et al. (2010), LFI-EMFs modify the cellular redox state. Thus, it is possible that one of the important effects of the LFI-EMFs is to influence redox processes in cells and tissues via the circulating blood. In addition, according to Simkó (2007), the cell type-specific redox status is responsible for the effects of diverse electromagnetic expositions. It seems that some possible effects of diverse electromagnetic fields are dependent on the cell type and the temporary spatiotemporal redox (and free radicals) patterns of cells. LFI-EMFs exposition could strengthen the cellular redox communication between cells and can influence the redox balance of the entire body via the circulating blood.

The skin as a neuroimmunoendocrine organ and LFI-EMF signals

The innervated skin is an extreme complex system and the largest organ of the body with numerous very important functions that is associated with the peripheral sensory nervous system (PNS), the autonomous nervous system (ANS), as well as the central nervous system (CNS) (Roosterman et al., 2006). The skin is not just a simple barrier protecting the body from dangers from the external environment. The skin bears densest and most complex innervation of all mammalian organs. There is growing evidence that the cutaneous peripheral nervous system has essential roles in skin homeostasis as well as in diseases. Cutaneous nerves can react to stimuli from the circulation and to emotions. Moreover, the central nervous system is directly (through efferent nerves or CNS-derived mediators) or indirectly (through the adrenal glands or immune cells) linked to skin functions (Figure 4) (Roosterman et al., 2006).

There is evidence that (Kreibig, 2010) autonomic nervous system serves as a major component in the emotion response. Recent studies support the notion that basic emotions have emotion-specific ANS activity/signature (Kreibig, 2010; Stephens et al., 2010). In Collet et al. (1997) experiments, basic emotion (happiness, surprise, anger, fear, sadness and disgust) induced specificity autonomic patterns in the skin regarding recorded parameters such as skin conductance, skin potential, skin resistance, skin blood flow, skin temperature and instantaneous respiratory frequency. It suggests that skin, as our largest organ, can represent stress related conscious and unconscious emotions directly by efferent nerves and mediators from CNS or indirectly by the adrenal glands or immune cells. The represented stress related conscious and unconscious emotions can affect on biochemical, bioelectrical and bioelectromagnetic patterns.

There is bidirectional communication between skin cells and the nervous system that has essential roles in homeostatic regulation during physiological and pathophysiological states (Roosterman et al., 2006). Under LFI-EMF expositions, first the skin meets electromagnetic fields that can exert a complex effect on skin mechanisms. These complex effects can spread by different mechanisms by modulation of specific neuropeptides released from cutaneous nerves that act on target cells by paracrine or endocrine pathway. It is now well appreciated that complex interactions exist linking sensory and autonomic nerves to the immune and endocrine systems. Moreover, the skin itself generates neuromediators and neurotrophic factors that target nerve fibers, thereby modulating inflammation, immune responses during host defense, pain, and pruritus. Recently, Arck et al. (2010) proposed a unifying model about the gut-brain-skin communication axis.

Acupuncture therapy has been applied to various psychiatric diseases and chronic pain since acupuncture stimulation could affect brain activity (Hori et al., 2010). Recently, Yu H et al., (2009) reported that magnetic stimulation on HeGu acupoint can modulate ongoing EEG and affect specific brain regions compared with the mock point. Chen et al. (2006) revealed by 3D (124-ch) EEG power spectrum mapping and source imaging that HeGu acupuncture stimulation modulates limbic cingulum by frequency modulation manner. Acupuncture studies indicate that induced signals from skin could affect brain activity.

According to Vianale (2008) experiments, ELF-EMF can modulate chemokine production and keratinocyte growth by inhibition of the NF-kappaB signalling pathway and thus may inhibit inflammatory processes. In addition, Patruno et al. (2010) reported that ELF-EMF modulate expression of inducible nitric oxide synthase, endothelial nitric oxide synthase as well as cyclooxygenase-2 in the human keratinocyte cells. Recent experiments support that pulsed electromagnetic or low energy and frequency magnetic fields influence the autonomic nervous system (Grote et al., 2007; Kraiukhina et al., 2010).

Nordlind et al. (2008) in their recent paper, titled, *The skin as a mirror of the soul: exploring the possible roles of serotonin*, state that, ".. alterations in the levels of 5-HT in extracellular fluids can alter the maturation, metabolism, migration and mitosis of its target cells, including those in both the brain and the skin. Serotonin (5-HT) is a significant bidirectional mediator between the neuroendocrine system and the skin. Recently, Irmak (2010) proposed that excitable Merkel cells in the skin (Merkel cells' function is still unclear), which are in close contact with sensory nerve endings, may take part in mammalian magnetoreception. The movement of melanosome with the changing electromagnetic field may open ion channels producing a receptor potential that can be transmitted to brain by sensory neurons.

All together, the above mentioned support that the LFI-EMF exposition can modulate biochemical, bioelectrical, and bioelectromagnetic processes in the skin and the modulated skin signals can affect the neuroendocrine system and modulate brain activity via ANS. Thus, the skin system may guarantee the spreading of low frequency and low intensity electromagnetic signals in the whole body in which LFI-EMF modulated cellular redox communication can also take significant roles.

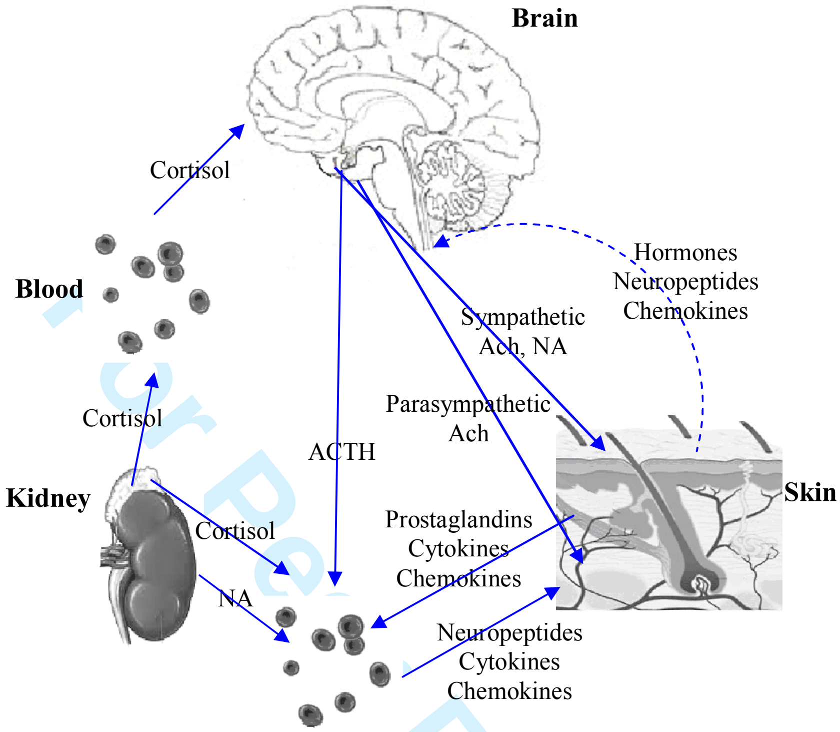

Fig. 3. Shematic illustration about complex communication between skin cells and the nervous system. Ach =acetylcholine, NA=noradrenaline, ACTH= Adrenocorticotropic hormone.

Case reports

In the next sections we report about results of routine alternative treatments carried out at Biolabor Biophysics and Laboratory Services Ltd by EMOST device. EMOST alternative routine treatments comply with the Declaration of Helsinki. Children's parents were informed about the EMOST method and they contribute to the treatments that were confirmed by their signatures. Parents also confirmed with their signatures that they contribute to report about results in scientific journal.

Case report 1

On April 2011 a 4-year-old girl was suffering from chronic constipation of unknown etiology had proved unresponsive to conventional treatments. According to her mother report, the girl had history of chronic constipation of 1 year. The girl was also hospitalized by history of constipation treated with enemas and laxatives and provided with food recommendations. The girl has not any learning or mental disabilities and physical examination revealed a good general condition.

Family anamnesis: The mother is raising her child alone under difficult financial and life circumstances since the child was born.

EMOST treatments: The collected bioelectromagnetic input signals of 4-year-old girl were processed by preprogrammed EMOST device. She was treated by output preprogrammed electromagnetic signals of EMOST device via a flat electrode for 6 sessions. Each session was approximately 30 min, between all treatments with a weak pause. During and after the girl had completed the six treatments, she did not receive any additional treatments related to the elimination of persistent constipation.

Results: After the girl had completed the six treatments she and her mother reported the elimination of chronic constipation. We should mention that, on February 2012, about one year after EMOST treatments, we have established contact with girl. However, there was no any further constipation during this year, and girl reported a better general healthy state.

Case report 2

On March 2012, a foster mother reported about persistent diarrhoea for the over one year in her 7-year-old girl. This twin girl in question has somatic and cognitive lag compared with children of similar age. Her weight and height were significantly lag compared with her twin girl. The twin girl in question had severe physical and mental load, before she was placed with her foster mother. The girl is wearing glasses. She has no known allergies or medications. Since this girl was placed with her foster mother (about on January 2011), girl has always stinking, mucoid, undigested and watery stools 1-2 times per day with abdominal complaints. The application of various probiotics and lactose-free diet were ineffective regarding the persistent diarrhoea. Coeliac test and abdominal ultrasound examination were also negative. Her laboratory workup was acceptable.

Perinatal anamnesis: Neglected geminate gravidity on 28th week with placenta abruption. Birth weight was 800 gram. The neonate girl was breathed for a week. In the 5th day she was suffered cerebral haemorrhage. In 1 month age she has necrotizing enterocolitis with ileum perforation. The perforated ileum segment was resected. She had received seven transfusions. In 7th month of age the ileostoma was closed. She was hospitalized for 7 months old. Due to the cholelithiasis she was treated by Ursofalk (ursodeoxycholic acid) to dissolve gallstones. In 2006, girl was examined via regular gastroenterology procedure because of the slow somatic progress, but there was not any chronic aberration.

Family anamnesis: The mother has totally neglected her twin daughters. What is known about the twin girl in question originated from the hospital reports. The twin girl in question had severe physical and mental load, before she was placed with a foster mother.

EMOST treatments: The collected bioelectromagnetic input signals of 7-year-old girl were processed by preprogrammed EMOST device. The patient was treated by output preprogrammed electromagnetic signals of device via a flat electrode for 14 sessions. Each session was approximately 30 min, between all treatments with a weak pause. During the girl had completed the 14 treatments, she did not receive any additional treatments related to the elimination of chronic diarrhoea.

Results: On June 2012, after 14 treatments, the foster mother reported that her girl has almost always normal stool and the incidence of slightly loose feaces is extreme rare (without mucoid stool). Girl has about one normal bowel movement per day, increased its power, and reported amount moderate abdominal discomfort. In addition, girl's appetite has been increased. We continue the EMOST treatment of this twin girl in question for improving her somatic and cognitive lag. We hope we can report its results in the close future.

Discussion and conclusions

The elimination of persistent intestinal catarrh and chronic constipation by LFI-EMFs by EMOST method in the described cases of two children well demonstrated the opportunity of the application of biophysical low-frequency and intensity electromagnetic fields. These young girls, for about one year, were suffering from persistent diarrhoea or chronic constipation (with unknown etiology) but the biophysical treatment could put and end to their sufferings. The 4-year-old girl was suffered essentially psychological load. But the 7-year-old twin girl had both severe physical and mental load, before she was placed with a foster mother. Later, 7-year-old twin girl needed much more treatment for elimination of her intestinal disease compared to former. It is promising that durability of the achieved results in the case of girl with chronic constipation, because about one year after EMOST treatments there was not any further constipation during this year, and girl reported a better general healthy state. We should emphasize that not only these two children with gastrointestinal disorders were successfully treated by EMOST method but numbers of young patients were recovered with various diseases by this method in the last years.

The particular effectiveness of EMOST method is possible due to the analogous process of own non-linear signals detected from skin that makes it possible that the biophysical information content of detected and back-transmitted electromagnetic signal is much larger than in digitized methods. In addition, the application of patient's own signals also makes it possible that all treatment can be individualized.

We briefly described two potential biological mechanisms such as redox processes and the bidirectional communication between skin cells and the nervous system regarding the effectiveness of LFI-EMF treatments. We also pointed out that skin system may guarantee the spreading of LFI-EMF signals in the whole body in which LFI-EMF modulated cellular redox communication also can have important roles.

However, in addition to the modern pharmacologic and psychological methods, LFI-EMF treatments and developments should get more possibility and attention in the application of biophysical treatment of diseases in the future, because during diverse diseases, cells and living systems not only display altered biochemical processes but also produce altered non-linear bioelectric and bioelectromagnetic complex patterns.

CONFLICT OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content.

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Figure legends

Figure 1. EMOST Redox 1.1. Medical Device (Certificate: HU11/6192) controlled by a personal computer.

Figure 2. Illustration about information-rich, natural (nonlinear) electroencephalogram signal, and artificial sinus and square signal forms.

Figure 3. Shematic illustration about complex communication between skin cells and the nervous system. Ach =acetylcholine, NA=noradrenaline, ACTH= Adrenocorticotropic hormone.

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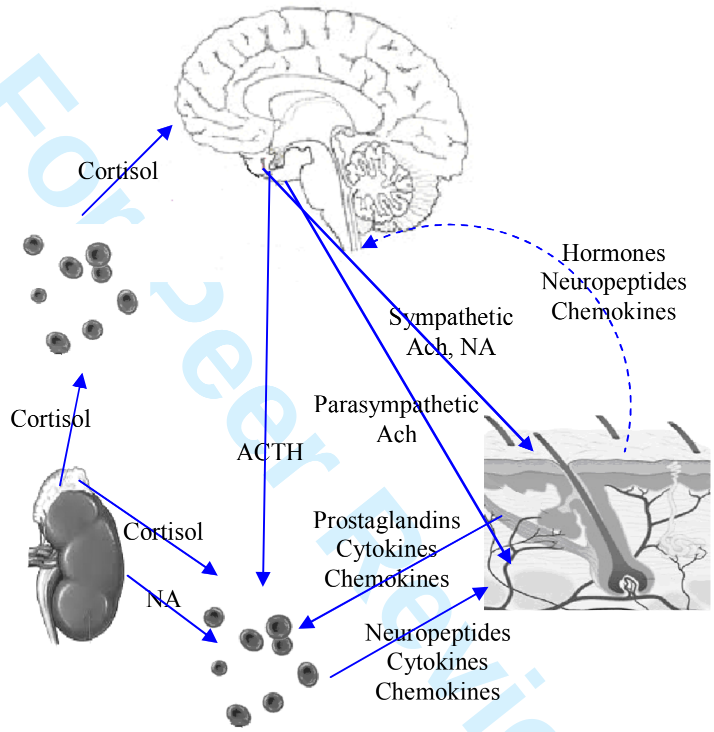

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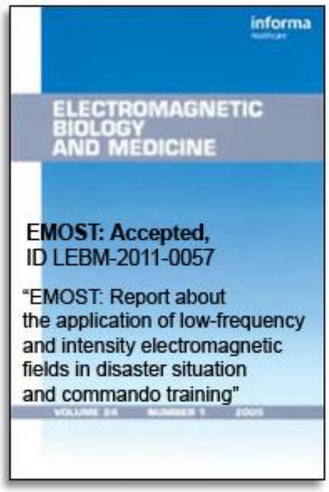

EMOST: Report about the application of low-frequency and intensity electromagnetic fields in disaster situation and commando training

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Running title: **Electromagnetic treatment in disaster and commando training**

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Abstract

Recently, we published our results (Bókkon et al. 2011 Electromagn Biol Med.) regarding the effectiveness of the EMOST (Electro-Magnetic-Own-Signal-Treatment) method for the reduction of phantom limb pain under clinical circumstances. However, EMOST treatments not only significantly reduced phantom pain, but that most of the patients also reported about additional benefits such as improvement of their sleep and mood quality after treatments. Here we report some unusual applications of EMOST method under special situations. That is, we report about our effective EMOST treatments of humans under catastrophic conditions and commando training course. This article points out that it is reasonable to apply biophysical electromagnetic management under unique circumstances. We also report some preliminary experiments on twelve members of our BioLabor regarding the effectiveness of single EMOST treatment on some serum parameters and electrocardiogram.

Keywords: EMOST treatments, Catastrophic conditions, Commando training

Introduction

To the best of our knowledge, the treatment of humans by low-frequency and intensity electromagnetic fields under special situations has never been reported before. In this article, we report on the application of our EMOST method (Electro-Magnetic-Own-Signal-Treatment) in disaster situation and commando training. The goal of this paper is to demonstrate the non ionizing biophysical electromagnetic management under real-life and unique conditions and not the presentation of clinical or controlled trials.

Health-promoting effects of low-frequency and intensity electromagnetic fields

While the health-promoting outcomes of low-frequency and intensity electromagnetic fields (LFI-EMFs) can be divisive, numerous experiments suggested that LFI-EMFs are able to initiate different healing processes, such as induction of analgesia, acceleration of bone fracture processes and wound healing (re-epithelialization), antiinflammatory effects, decrease of fatigue and depression symptoms, improvement of multiple sclerosis, fibromyalgia, and chronic pulmonary disease, improvement of cardiovascular parameters, improvement of sleep and psychiatric disorders, etc. (Baldi et al., 2007; Barzelai et al., 2009; Mach and Persinger, 2009; Mancuso et al., 2007; Nishimura et al., 2011; Sandyk, 1997; Ghione et al., 2005; Kumar et al., 2005; Lappin et al., 2003; Satter Syed et al., 1999; Selvam et al., 2007; Patruno et al., 2010; Sutbeyaz et al., 2009; Zhang et al., 2007; Tsang et al., 2009; Cvetkovic and Cosic, 2009).

The contradictions of LFI-EMFs on health-promoting effects are due to several factors, among them: the lack of standardized experimental circumstances; the unsystematic application of artificial LFI-EMF signals; and furthermore the cell type-specific redox status can also be responsible for the effects of electromagnetic expositions (Simkó, 2007).

Too long expositions of LFI-EMF treatments are also extremely problematic. During LFI-EMF experiments and treatments, LFI-EMF radiations with a short-term exposition (less than 45 min) can facilitate the immune system and cellular processes [*](for example, through redox activation processes), but a long-term or continuous exposition to LFI-EMFs causes a decline in cytoprotection and can shift the redox and calcium homeostasis of cells (Di Carlo et al., 2002; Regoli et al., 2005).

[*]LFI-EMF exposition → stimulation of cellular membrane NADPH oxidase activity → superoxide redical generation $O2^{-}$ → increased activity of calcium channels Ca^{2+} and lipoxygenases → start of arachidonsav cascade and lipid peroxidation processes → expansion of signaling pathways in cells.

EMOST system

Our EMOST medical device can detect and scene non-linear, bioelectric and bioelectromagnetic signals of the patient (Bókkon et al., 2010, 2011a, 2011b). The collected signals from patients' skin are processed by preprogrammed EMOST device (Fig. 1). The patients are treated by preprogrammed signals of EMOST device (frequencies are in the range of 1 Hz - 1 MHz; intensity range between 0.1-10 micro Teslas, via very special input/output flat electrodes). A particular feature of our EMOST method - compared to many electromagnetic equipments - is that the patient's own bioelectromagnetic signals, which are detected from skin are processed via analogue manner (non-digitalized) inside the EMOST device. This signals are transmitted back via a flat electrode radiator through different band/signal combinations, with some amplification (-20dB- +60dB), to the skin's surface on the opposite side and extended by the higher range sounds of the signal. The special analogous signal process of EMOST device makes it possible that the biophysical information content of detected and back-transmitted electromagnetic signal is much larger than in digitized methods.

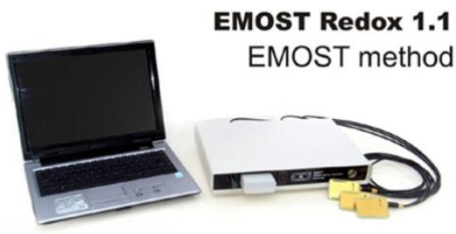

FIGURE 1 EMOST Redox 1.1 Medical Device (Certificate: HU11/6192) controlled by a personal computer.

Some possible effects of LFI-EMFs

Many possible mechanisms of various classical and quantum models have been suggested to elucidate the influence of LFI-EMFs in living systems (Binhi, 1999; Bókkon and Salari, 2010). A growing body of evidence suggested that several effects of LFI-EMFs therapies can be elucidated (or connected) by redox regulation and membrane-bound receptor mechanisms (Bauréus et al., 2003; Foster, 2003; Mathie et al., 2003). In addition, many experiments have revealed that reactive oxygen and nitrogen species as well as their derivatives act as essential signals in intracellular and intercellular communication (Dröge, 2002; Bókkon and Antal, 2011; Feissner et al., 2009; Kishida and Klann, 2007; Massaad and Klann, 2011; Powers et al., 2011; Valko et al., 2007; Zhang and Gutterman, 2007). The effect of LFI-EMFs on cell membranes and membrane-bound receptors can stimulate Ca2+-related pathways and free radical and redox-regulated processes. Thus, some of the fundamental effects of the EMOST treatment may be achieved via the redox balance of the body. It is likely that EMOST method can convey the detected and changed electromagnetic patterns of defective cells for surrounding and other cells, which facilitates intercellular communication via redox sensitive biochemical processes, and help restoration of homeostasis.

Biophysical therapeutic opportunities by LFI-EMF

Although modern pharmacology has made considerable progress in the medication of various diseases, we should also recognize that in many cases pharmacology treatments could be ineffective. In these cases, the biophysical LFI-EMF methods may offer some additional opportunities, because in various diseases, living cells do not only show altered biochemical processes but also generate altered non-linear bioelectric and bioelectromagnetic signals. Since each patient has a unique description of his/her own particular diseases, application of bioelectromagnetic own signals (EMOST) of patients for therapeutic applications may be effective especially compared to the diverse, artificial electromagnetic signals.

EMOST: phantom pain, sleep and mood quality

Recently, we presented our results regarding the effectiveness of the EMOST treatment (for six sessions) and the reduction of phantom limb pain under clinical circumstances (Bókkon et al., 2010, 2011a, 2011b). The EMOST method not only significantly reduced phantom pain, but also revealed additional benefits at most of the patients after expositions, such as improvement of their sleep and mood quality (Fig. 2).

We briefly mention here that we have established contact one year after our clinical EMOST experiments with those who took part in our research. However, there was no any further amputation in the EMOST treated patients during this year, and exposed patients reported a better general healthy states compared to sham exposed (control group). Pain is a key issue among veterans and members of the military due to increased survival rates from devastating injuries, including phantom limb pain after amputations (Ebrahimzadeh and Hariri, 2009; Wartan et a., 1997).

Since in many cases, various phantom pains can be disabling and can lead to a lifelong struggle with chronic pain, our EMOST method may offer a new possibility for the reduction of individual phantom pains.

FIGURE 2 Treatment of amputees by EMOST in the clinic.

Stress responses

Task stressors are a common problem in police officers, soldiers, veterans, as well as in special commandos (Carlier et al., 2000; Renck et al., 2002; Miller, 2011). The exposure to diverse violent situations, witnessing distressing events and seeing victims are some of the task related stressors. These task stress induced symptoms can range from mild to severe.

Traumatic stress experiences often produce peritraumatic stress responses during and immediatelly after effects of trauma and in subsequent acute and posttraumatic stress responses in stress exposed subjects. However, the perception of stress is individual dependent. What is stressful to **X** person may not cause stress in **Y** person, because it depends on the person's previous experiences, emotional and mental states.

Sleep disturbances and interpersonal problems are highly prevalent in military and police subjects with various scales of stress disorders that are associated with substantial co-morbidities and increased healthcare risks (Capaldi et al., 2011). PTSD symptoms may include nightmares, disturbing thoughts, re-experiencing phenomena, being socially detached from family and friends, hyper-arousal (such as feeling angry, irritable), etc.

Several evidences indicated that traumatic stress exposures and PTSD are common anxiety disorders in military and police subjects as well as in normal populations and can be associated with cardiovascular diseases, chronic fatigue syndrome, musculoskeletal disorders, etc. (Boscarino, 2004). People with PTSD are more likely to have hypertension, obesity, hyperlipidemia, and cardiovascular disease.

The biological processes that account for the observed associations between PTSD and cardiovascular disease may relate to dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis and for continual over-stimulation of the autonomic nervous system that can promote the increases in blood pressure and lipid levels (Bedi and Arora, 2007).

Immune function changes in PTSD subjects may also influence circulating levels of interleukin-6 (IL-6), IL-1, tumor necrosis factor (TNF), and C-reactive protein (CRP) (Rohleder and Karl, 2006). However, inflammatory mediators such as TNF, CRP, and IL-6, can stimulate atherosclerosis. Interactions among the immune and neuroendocrine systems may partly account for associations between PTSD and chronic disease outcomes.

Psychological and medical treatments for PTSD include group or individual psychotherapy (for example, cognitive-behavioral therapy) and pharmacotherapy such as the use of selective serotonin reuptake inhibitors (Spoont et al., 2010).

EMOST treatment of police commandos during training exercise

In 2011, we performed some EMOST treatments of twelve Hungarian police commandos (elite forces) during their hard training exercise. During commando trainings, police officers had been exposed to very difficult physical and psychological conditions for tree weeks. We provided our treatments (with official permission) on three consecutive days in the last week of exercising. The commandos came and went for shooting practice, physical training etc., and when they have a little pause, we performed EMOST treatments. As the Figure 3 shows, commandos were lying on the hard tables (sometimes with weapons) during EMOST treatments. So, the situation was very realistic.

The commandos were asked to rate their physical and psychological conditions on the 0–10 verbal numerical rating scale prior to the treatment and after the treatment during each three days. We also measured their cardiovascular risks prior to the treatments and after the treatments, and studied the speed of their reflexes via a simple task. Following the trend of the three treatments, after the third treatment, the studied parameters clearly showed a downward trend in cardiovascular risks, an improved physical and psychological conditions as well as a slightly increased reflex.

FIGURE 3 (A) Commandos were lying on the hard tables during EMOST treatments. (B) Prompt measure of cardiovascular risk.

EMOST treatments during flood disaster in Felsőzsolca, Hungary

Felsőzsolca is a small town in North-East of Hungary. In June, 2010 the biggest flood hit Felsőzsolca. Out of a total of 2200, about 1800 houses were damaged, and over 200 houses collapsed by the river Sajó. In addition to local residents, hundreds of soldiers, firefighters and volunteers helped to save lives. The local government leaders as well as military and firefighter commanders continuously managed the rescue processes. Many managers had no sleep in 48 hours, and several residents suffered PTSD. Some voluntary psychologists also tried to reduce the extreme psychological stress caused by the flood.

Since our several years of EMOST application and our experiments indicated that EMOST can produce prompt effect to reduce stress and fatigue levels and to improve sleep and mood quality in patients, our BioLabor group also took part as volunteers in Felsőzsolca rescue-actions by EMOST treatments of several commanders and local residents that were exhausted at the border (see Figure 4 with our photos). We have treated about 80 managers and residents by some of special EMOST regeneration program. Most of the treated subjects rendered benefit improvements after 40 min treatment reported their reduced stress and fatigue levels and improved mood quality and concentration ability.

After traumatic stress (that frequently result in peri-traumatic stress), the sooner we use a variety of therapies, the smaller the chance to develop acute or posttraumatic stress state. However, biophysical LFI-EMF treatments may offer a special and prompt help in many particular situations.

FIGURE 4 Our photos have been taken in Felsőzsolca. (A) EMOST treatments of exhausted and stressed local residents, soldiers, firefighters. (B) Our car and local residents in a flooded street in Felsőzsolca, on June. 2010. (C) Residents used a boat to cross a flooded street in Felsőzsolca.

Preliminary experiments: Single EMOST treatment effect on electrocardiogram and the serum concentration of urea, albumin, cortisol, chloride, CPK, TSH, and CRP

We performed some preliminary experiments on twelve members of our BioLabor regarding the effectiveness of single EMOST treatment on some serum parameters and electrocardiogram (ECG). ECG results did not show statistic significant improvement after single EMOST treatment. In contrast, some serum factor such as uric acid, albumin, cortisol, chloride, Creatine phosphokinase (CPK), Thyroid stimulating hormone (TSH), C-reactive protein (CRP) indicated some remarkable changes following one treatment.

Cortisol, TSH, CRP, and CPK serum concentrations were reduced in the most of us. The albumin concentration usually showed a slight decrease and the uric acid concentration increased in almost all cases. Chloride level of serum showed a slight increase in almost every case. Of course, these few preface experiments have no great importance, but indicate EMOST treatment may reduce stress factors and affect on the redox/free radical processes as numerous studies reported regarding to the effect of low-frequency and intensity electromagnetic fields.

For example, cortisol levels were decreased in most of the members of our BioLabor after one EMOST treatment. Cortisol is a (glucocorticoid) steroid hormone that produced by the adrenal cortex in response to stress(Inslicht et al., 2011). Its major functions are, among them, to increase blood sugar through gluconeogenesis and suppress the immune system, but recent studies revealed that glucocorticoids (cortisol) have both stimulatory and suppressive effects on immune responses that are dependent on the GC concentration (Yeager et al., 2008).

Uric acid concentration increased in almost all cases after single EMOST treatment. However, uric acid is strong reducing agents (electron donors) and potent antioxidants (Warning, 2002). In humans, about the half the antioxidant ability of blood plasma comes from uric acid (Maxwell et al., 1997).

Chloride level also showed a slight increase in almost every case. Chloride is a prominent negatively charged ion in the blood, where it represents about 70% of the body's total negative ion content. However, chloride level has essential role of blood pH value that can influence pH-dependent redox/free radical processes. It seems that EMOST treatments may transiently potentiate functional redox processes.

However, we have started a large-scale, controlled testing of EMOST treatments (with forty subjects and with sham exposed controls) regarding its effectiveness on serum parameters and electrocardiogram. We hope that we can report the results in the near future.

Discussion and Conclusions

We have to stress again that our goal was not the presentation of clinical or controlled trials, but show the non ionizing electromagnetic management under real-life and also in unique conditions.

One may argue that the presented beneficial effects of our EMOST treatments were due to the placebo effect. However, it is unlikely that EMOST treatments could produce placebo effect on eighty subjects under flood disaster. In addition, during many years of EMOST application, we also effectively treated hundreds of children and babies with diverse health problems. It is also hardly possible that EMOST treatments could make placebo effects on babies. Furthermore, our recently published results on the effectiveness of the EMOST in reduction of phantom limb pain as well as improvement of the quality of sleep and mood in subjects under clinical circumstances also support the real effectiveness of EMOST.

Because the EMOST method based on non-linear, bioelectric and bioelectromagnetic signals of patients, it offers tailor-made opportunities. In addition, it is not realistic to apply a large number of psychologists under unexpected events and disaster conditions.

The presented EMOST application (Electro-Magnetic-Own-Signal-Treatment) under disaster conditions and commando training, may point out a further possible way of healing therapies in addition to the modern pharmacologic and psychological methods. We should also consider that the sooner we use a variety of therapies, the smaller the chance to develop acute or posttraumatic stress status after unexpected and disaster situations.

The aforementioned few preliminary experiments on members of our BioLabor regarding the efficiency of single EMOST treatment on serum parameters and electrocardiogram indicated that it is worthy to perform a large-scale, controlled testing that we have started.

Besides, not only for stress management should be considered, but also improve mental and physical states, concentration, cognitive and situation analysis abilities of exhausted troops and policemen after unexpected and catastrophic events.

In summary, we should consider biophysical electromagnetic managements as a further possible way of healing therapies in addition to the pharmacologic and psychological methods, especially under unique, unexpected and disaster situations.

CONFLICT OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content.

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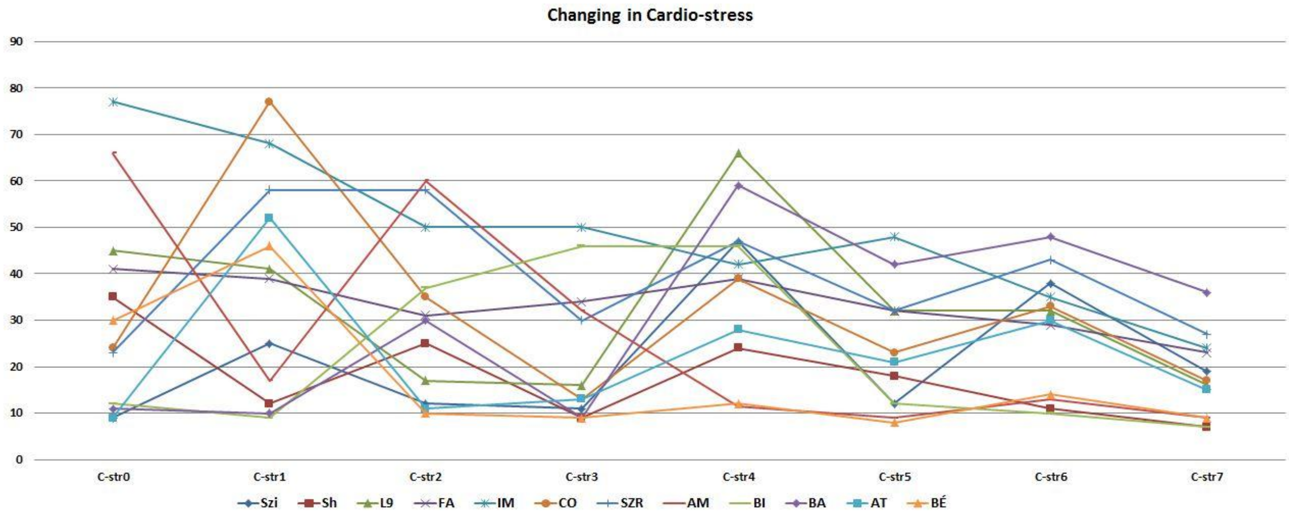
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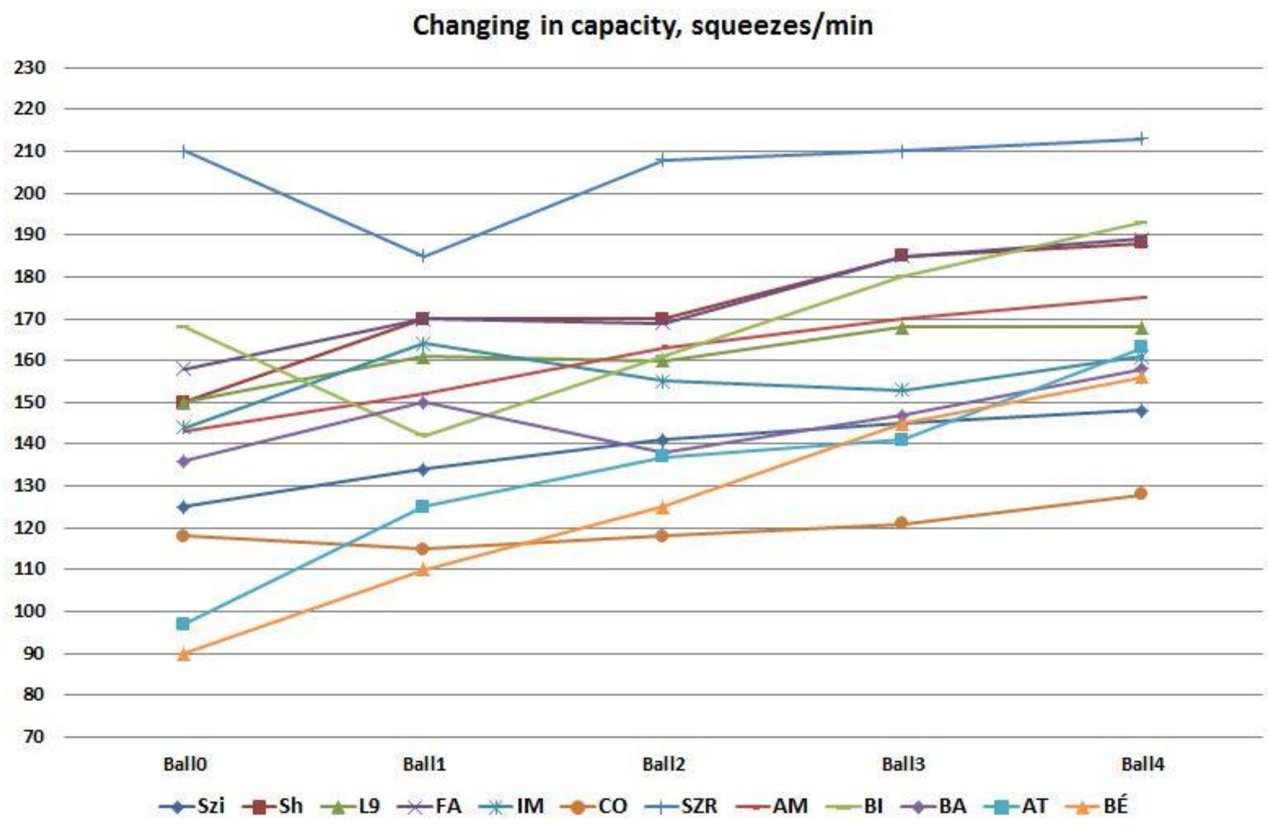
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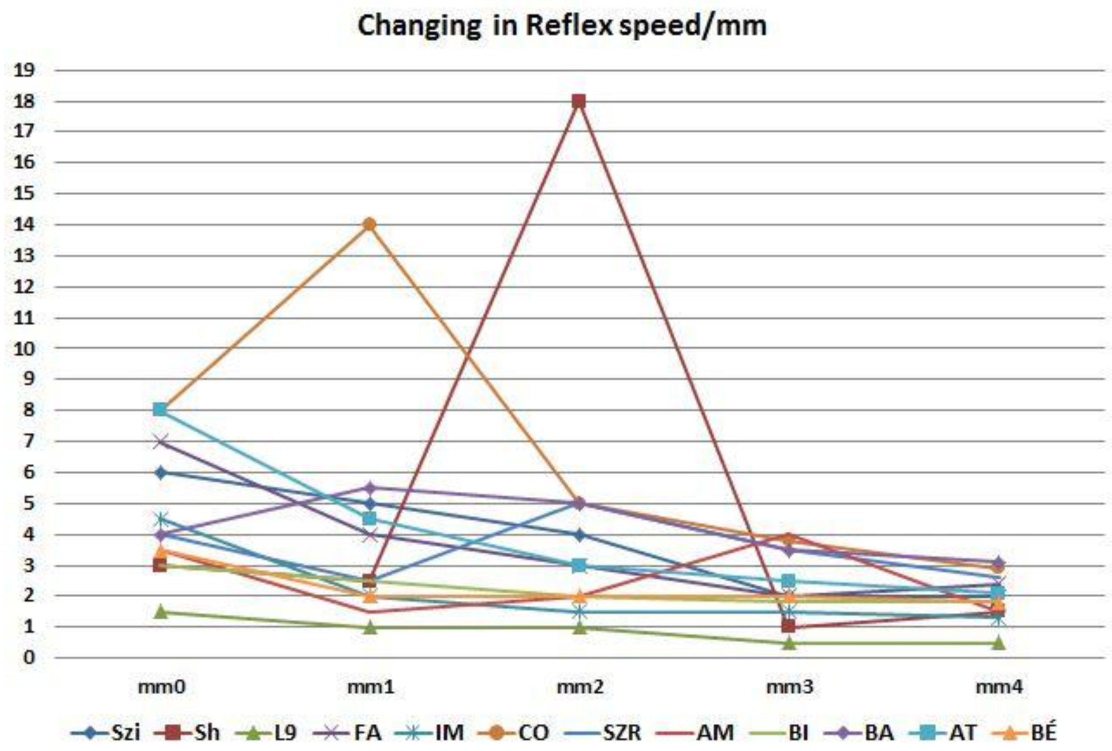
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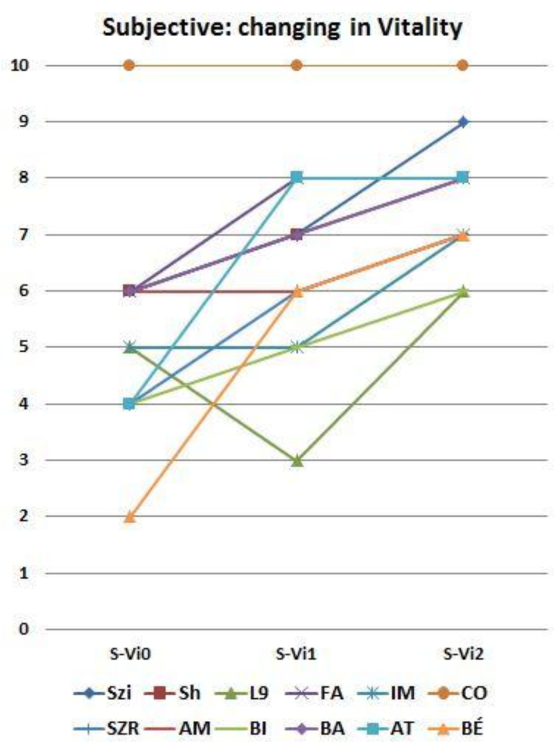
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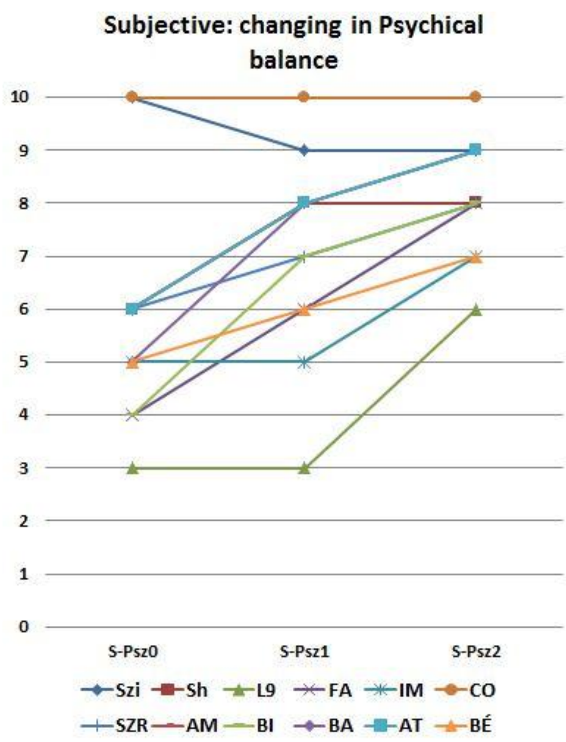
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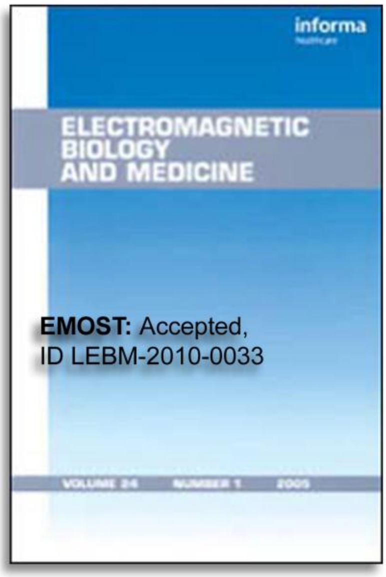

Phantom pain reduction by low-frequency and low-intensity electromagnetic fields

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Abstract

Although various treatments have been presented for phantom pain, there is little proof supporting the benefits of pharmacological treatments, surgery or interventional techniques, electroconvulsive therapy, electrical nerve stimulation, far infrared ray therapy, psychological therapies, etc. Here, we report the preliminary results for phantom pain reduction by low-frequency and intensity electromagnetic fields under clinical circumstances. Our method is called as Electromagnetic-Own-Signal-Treatment (EMOST). Fifteen people with phantom limb pain participated. The patients were treated using a pre-programmed, six sessions. Pain intensity was quantified upon admission using a 0-10 verbal numerical rating scale. Most of the patients (n=10) reported a marked reduction in the intensity of phantom limb pain. Several patients also reported about improvement in their sleep and mood quality, or a reduction in the frequency of phantom pain after the treatments. No improvements in the reduction of phantom limb pain or sleep and mood improvement were reported in the control group (n=5). Our non-linear electromagnetic EMOST method may be a possible therapeutic application in the reduction of phantom limb pain. Here, we also suggest that some of the possible effects of the EMOST may be achieved via the redox balance of the body and redox-related neural plasticity.

Keywords: Phantom pain, Low-frequency and intensity electromagnetic fields, EMOST method, Redox-related neural plasticity

Introduction

The amputation of a limb is generally followed by a sensation that the deafferented body part is still present. Phantom limb sensations can be generally perceived by amputees following amputation (Ramachandran and Hirstein, 1998). However, phantom limb sensations can also occur following spinal cord injury, nerve avulsion and in children with congenital limb aplasia (Moore et al., 2000; Melzack, 1992; Melzack et al., 1997). The phantom sensations usually resolve without treatment, except in cases in which phantom pain develops.

When amputees sense an intense pain in their missing body part, the phenomenon is known as phantom pain. Phantom pain is more frequent in patients with preamputation pain and is less likely in cases in which the amputation was performed when the patient was very young. While phantom pain is most common after the amputation of a leg or an arm, it can also occur after the surgical removal of a breast, rectum, testicle, penis, or eye, among others (Flor, 2002). The phantom pain aftereffect occurs in 50-80% of the patients who have undergone this type of surgery, and the most frequently reported types of pain include burning, tingling, and cramping (Sherman, 1994). Various other pains and types of sensation such as shocking, itching, shooting, squeezing, and throbbing, among others, can also occur. Although a high percentage of amputees experience phantom pain, every patient has a unique description concerning his/her particular sensations and the pain experienced, as well as the intensity and frequency of the sensations. Phantom pain generally resolves without treatment, except in cases in which chronic phantom pain develops.

There is increasing evidence that both peripheral and central neural mechanisms are involved in phantom pain, but the pathophysiological mechanisms of phantom pain remain unknown (Devor and Seltzer, 1999; Dhillon et al., 2005; Davis et al., 1998; Mackert et al., 2003; Mercier et al., 2006; Karl et al., 2001). One possible peripheral mechanism is that neuromas (a growth of the nerve tissue) form injured nerve endings at the stump site after the amputation of a limb and fire abnormal action potentials. In addition to peripheral processes, spinal mechanisms have also been considered to influence phantom pain (Bittar et al., 2005). Phantom limb pain is also strongly correlated with changes in the representational plasticity (cortical reorganization) in the somatosensory and motor cortices. According to the neuromatrix theory, there is an extensive, genetically predetermined, network that interconnects the thalamus-cortex-limbic system, and phantom pain could arise from an atypical reorganization of this neuromatrix (Melzack, 1993; Bittar et al., 2005). Psychological factors have also been investigated. Whereas psychological factors do not appear to cause the phantom pain, these factors might affect the severity and the progression of the pain (Sherman et al., 1987).

Although various treatments have been presented, there is little clinical proof supporting the benefits of pharmacological treatments, surgery or interventional techniques, electroconvulsive therapy, electrical nerve stimulation, far infrared ray therapy, pulsed radiofrequency ablation, or psychological therapies (for instance, mirror box therapy), among other treatments (Gnezdilov et al., 1995; Rasmussen and Rummans, 2000; Wiech et al., 2004; Irlbacher et al., 2006; Wilkes et al., 2008; Huang et al., 2009; Seidel et al., 2009; de Roos et al., 2010).

Here, we report the preliminary results for phantom pain reduction by Electromagnetic-Own-Signal-Treatment (EMOST) under clinical circumstances. Our EMOST method does not perform any electromagnetic wave modulation or wave inversion (phase shift) of recorded output bioelectric and bioelectromagnetic signals of subjects. EMOST method solely employs filtered, various low-frequency and intensity electromagnetic fields (between 1 Hz - 1 MHz) that is controlled via preprogrammed computer. The EMOST device is based on our new concept, i.e., very fast electromagnetic feedback of recorded bioelectromagnetic signals of subjects without any changes could promote and reinforce intra- and intercellular redox communication. We also discuss that low-frequency and intensity electromagnetic fields (LFI-EMFs) may influence the cortical reorganization and the neurogenesis.

Materials and Methods

Patients

Limb amputees (*with vascular and* arterial disease**,** *diabetes and accidents*) were recruited at the National Institute for Medical Rehabilitation in Budapest, Hungary. The limb amputees (experimental amputees (n=10) and control amputees (n=5)) were randomized to receive either an active EMOST treatment or a sham treatment. Our EMOST experiments were performed by permission of the Ethics Committee of the National Institute for Medical Rehabilitation, Budapest, Hungary.

Apparatus

The EMOST device (BioLabor-MCC HI 2.5.2) was used in the experiments. It contains three basic elements: (1) an input electrode, (2) signal-processing circuits and (3) an output electrode. The input and output flat electrodes were placed on the joints of patients. The input signals were originated from bioelectric and bioelectromagnetic signals of patients who were placed in direct contact with the specially designed flat electrodes. The input signals were recorded similarly to extracting information from electromagnetic brain function via electroencephalogram (EEG). Namely, the EMOST device (which is controlled by a personal computer) operates with the non-linear, bioelectromagnetic signals of the patient within preprogrammed frequency ranges (between 1 Hz - 1 MHz). The parameters (input filtered frequency ranges and output intensity) and exposure time can be preprogrammed. The collected input signals of patients can be filtered using pre-programmed, low-frequency ranges (between 1 Hz - 1 MHz) by device circuits. Output, low-frequency electromagnetic signals were emitted by an identical flat electrode. The output electromagnetic intensity range of the device is 0.1-10 microteslas. A photograph of the EMOST apparatus is shown Figure 1.

Figure. 1. The EMOST device (BioLabor-MCC HI 2.5.2) is controlled by a personal computer.

Treatments

The present research conformed to the Helsinki Declaration outlining the principles for medical research involving human subjects. All of the subjects completed an informed consent form prior to participation in the study. The collected bioelectromagnetic input signals of patients were processed by preprogrammed EMOST device. The patients were treated by output preprogrammed signals of EMOST device (frequencies in the range of 1 Hz - 1 MHz; intensity range between 0.1-10 micro Teslas) via a flat electrode (Fig. 2) for six sessions. Each session was approximately 45 min, between all treatments with a one-day pause. Sham exposed patients (control group) were placed in the same conditions as the exposure groups but EMOST device was turned off. Subjects could not notice anything different from active and sham treatments. Pain intensity was quantified upon admission using a 0-10 verbal numerical rating scale (NRS) (Fig. 3). The patients were asked to rate their pain on the verbal NRS prior to the therapy and after they had completed the six treatments. During and after the patients had completed the six treatments, they did not receive any additional treatments related to the reduction or elimination of phantom limb pain.

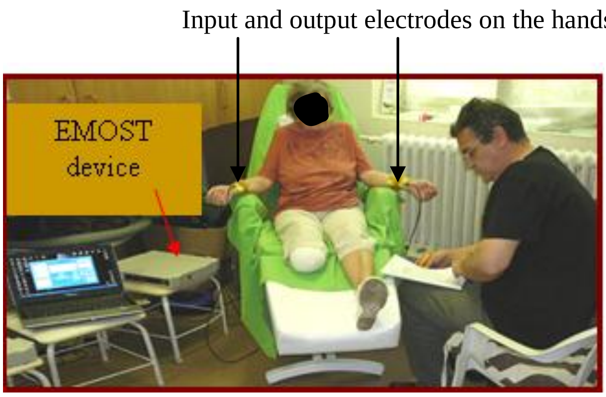

Figure. 2. Photograph of an amputee undergoing an EMOST treatment. While the operator was collecting patients' reports he was blind to the type of treatment (i.e., active or sham treatments).

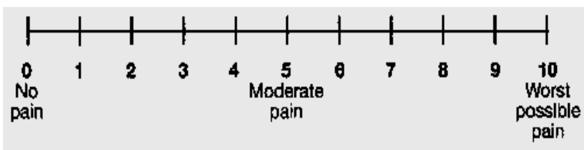

Figure. 3. Verbal numerical rating scale.

Results

The Student's t-test was used to analyze the data. The reduction of phantom limb pain by EMOST was statistically significant (*P < 0.05) as compared to the controls. Although our goal was to reduce phantom limb pain (or reduction in the frequency of phantom pain (PP↓)) via EMOST treatments, most of the patients also reported a marked improvement in their sleep and mood quality after the treatments. No improvements in the reduction of phantom limb pain or sleep and mood improvement were reported in the control group. The results obtained after six EMOST treatments are summarized in Table 1. All patients were followed for 2 weeks following their completed six treatments and there were no major differences in terms of phantom pain relief during this time.

	Patients	**Phantom pain intensity before the treatments**	**Phantom pain intensity after six completed EMOST treatments**	**Interval between the amputation date and the EMOST treatments**	**Additional improvements reported by patients after six EMOST treatments**	**Disease or Accident**
Patients with EMOST treatments	**I.**	6	0	1 month	Sleep	Diabetes
	II.	7	3	1/2 year	Sleep	Arterial
	III.	8	4	2 years	Mood	Diabetes
	IV.	6	2	1 month	Sleep, Mood	Arterial
	V.	1	0	8 years	Sleep, Mood	Arterial
	VI.	3	2	1 month	Sleep, Mood PP frequency↓	Arterial
	VII.	7	2	1 month	Sleep, Mood	Diabetes
	VIII.	7	4	1 month	Mood	Accident
	IX.	7	0	3 years	Sleep PP frequency↓	Diabetes
	X.	7	6	5 years	Mood	Diabetes and arterial

Table 1. This table summarizes the phantom pain intensity observed after completion of six EMOST treatments and additional improvements reported by the patients (The control group is not shown).

Discussion

Some possible effects of LFI-EMFs on cellular processes

Living cells display a particularly weak non-linear electromagnetic activity in a wide spectrum of frequencies - from Hz to THz, in cells (Fraser and Frey, 1968; Levin and Korenstein, 1991; Isojima et al., 1995; Cohen and Popp, 1997; Kobayashi et al., 1999; Pokorný et al., 2001; Lipkova and Cechak, 2005; Pelling et al., 2005) - that can be generated by diverse cellular mechanisms that are associated with biochemical processes.

Although the health effects of low-frequency and intensity electromagnetic fields (LFI-EMFs) are controversial, increasing evidence suggests that non-ionizing LFI-EMFs can influence numerous cell functions and are capable of initiating various healing processes, such as the delay of fractures, induction of analgesia, acceleration of wound re-epithelialization, inhibition of inflammatory processes, reduction of fatigue, improvement of multiple sclerosis and chronic pulmonary disease, among others (Orgel et al., 1984; Selvam et al., 2007; Reiter 1993; Satter Syed et al., 1999; Lappin et al., 2003; Kumar et al., 2005; Alfieri et al., 2006; Zhang et al., 2007; Markov 2007a; Tsang et al., 2009; Huo et al., 2009; Sutbeyaz et al., 2009; Mach and Persinger, 2009; Mancuso et al., 2007; Jing et al., 2010; Patruno et al., 2010).

Many potential causes have been suggested to explain the influence of LFI-EMFs in living systems, for example, Eddy electric currents, classical and quantum oscillator models, by the help of biomagnetites, cyclotron resonance, the interference of quantum states of bound ions and electrons, coherent quantum excitations, stochastic resonance, parametric resonance, bifurcation, and magnetosensitive free-radical and redox processes, among others (Binhi, 1999; Bókkon and Salari, 2010). Despite these explanations, the primary effect of LFI-EMFs on cell functions remains unclear. However, several effects of extremely low-frequency electromagnetic therapies may be explained (or connected) by redox regulations and membrane processes (Patruno et al., 2010; De Nicola et al., 2006; Di Loreto et al., 2009; Morabito et al., 2010).

Numerous experiments have provided evidence that reactive oxygen species (ROS) and reactive nitrogen species (RNS) and their derivatives act as fundamental signals (secondary messengers) during physiological (and pathophysiological) processes in intracellular signaling and intercellular communication processes (Hidalgo et al., 2000; Hancock et al., 2001; Dröge, 2002; Kamsler and Segal, 2007; Valko et al., 2007; Kishida and Klann, 2007; Forman et al., 2008; Bókkon and Antal, 2010). Because several effects of LFI-

EMFs can be explained by redox regulation and membrane processes, LFI-EMFs may have an important effect on redox mechanisms.

A growing body of evidence indicates that cell membranes play a key role in the transduction and amplification of LFI-EMF field signals (Bauréus et al., 2003; Foster, 2003; Mathie et al., 2003). Specifically, LFI-EMFs can affect the length of cell membranes and the number and variety of membrane-bound receptors. However, the activation of many cell surface receptors (for example, G protein-coupled receptors and receptor tyrosine kinases, among others) induces an influx of Ca^{2+} into the cells and the release of Ca^{2+} from the endoplasmic reticulum. Because ROS and calcium signals are intimately interconnected and calcium and ROS constitute the most significant intracellular signaling molecules in the regulation of various cellular functions (Gordeeva et al., 2003; Yan et al., 2006; Feissner et al., 2009), the effect of LFI-EMFs on cell membranes and membrane-bound receptors may cause these radiations to stimulate Ca^{2+}-related pathways and free radical and redox-regulated processes. Several cell surface receptors are regulated by redox processes (Dröge, 2002; Bókkon and Antal, 2010; Choi and Lipton, 2000; Nakashima et al., 2002; Kishida et al., 2005; Yang et al., 2006; Monteiro et al., 2008; Shi et al., 2010). Figure 4 shows_some possible effects of LFI-EMFs on cellular processes.

In addition, LFI-EMF can have effects on the molecular transition states and can affect the kinetic processes of enzymes without thermodynamic kT energy. Importantly, magnetic fields are more effective when the tissue is out of equilibrium (Markov, 2007b). Consequently, LFI-EMFs experiments in healthy individuals do not reflect the potential response of patients who have endured an injury or disease. Because the cell type-specific redox status is responsible for the effects of diverse electromagnetic expositions (Simkó, 2007), it is possible that the effects of diverse electromagnetic fields are dependent on the cell type and the temporary spatiotemporal redox (and free radicals) patterns of cells.

It is important to note the role of exposure time during LFI-EMF therapies is especially critical. Radiations with a short-term exposure (according to our experience, less than 45 min) can facilitate (for example, through redox activation processes) the immune system and cellular processes, but a long-term or continuous exposure to LFI-EMFs results in a decline in cytoprotection (Regoli et al., 2005; Di Carlo et al., 2002). Long-term electromagnetic radiations may shift the redox and calcium balance, which could cause additional cellular malfunctions. For example, NMDA receptors can be redox modulated by

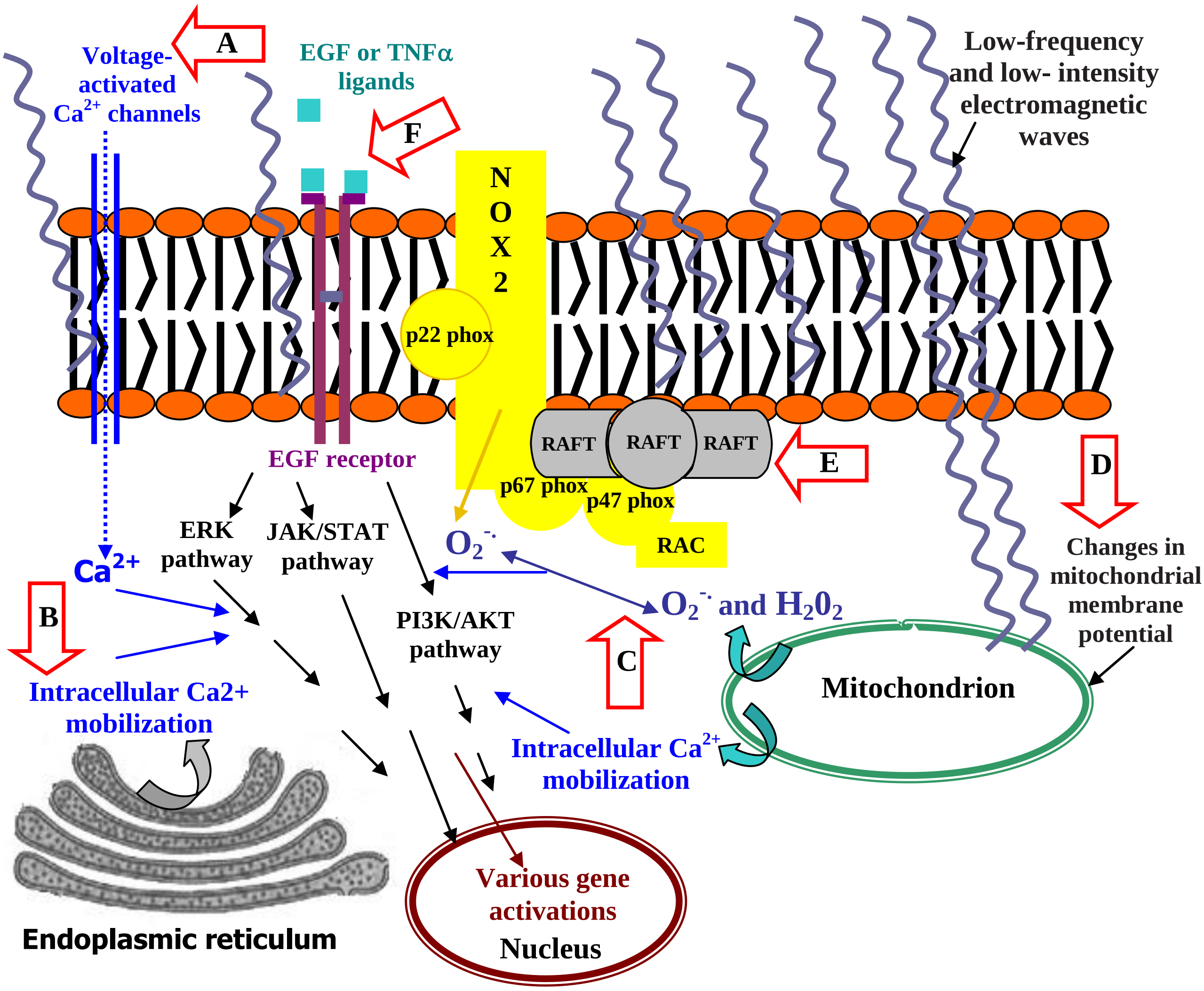

Figure. 4. Some possible effects of LFI-EMF fields on cellular processes. A growing body of evidence indicates that cell membranes, mitochondria, Ca^{2+} and ROS play key roles in the transduction and amplification of LFI-EMF field signals. ELF-EMFs may be capable of inducing a shift in cell status to an "activated" state. Lipid rafts (REFT, membrane microdomains) can play essential roles during the activation of membrane-bound receptors and enzymes by ELF-EMFs. **A.** Increases the open-channel probability. **B.** Intracellular Ca^{2+} mobilization. **C.** Increased intracellular $O_2^{-\cdot}$ and H_20_2 levels. **D.** Changes in mitochondrial membrane potential. **E.** Facilitation of NADPH oxidase (NOX) aggregation by membrane lipid drafts. **F.** Facilitate assembly and activation of membrane-bound receptors.

hydroxyl radicals (Aizenman, 1995), but long-term or continuous exposure to LFI-EMFs provoke aberrant NMDA receptor activities (Manikonda et al., 2007).

In most LFI-EMF experiments or treatments, various devices employ diverse artificial frequencies, which are waveforms that are modulated with respect to the frequency or the amplitude. LFI-EMFs with different characteristics, including different waveforms, frequencies and modulations, can have diverse (*or even opposing*) effects on biochemical signal processes during experiments. In other words, the effects of electromagnetic fields are associated with the type of electromagnetic field that is applied (Walther et al., 2007).

During various diseases, cells not only demonstrate altered biochemical processes but also produce altered non-linear electromagnetic complex patterns. Because it is impossible to investigate the whole range of artificial LFI-EMFs for potential therapeutic applications, it seems reasonable to use non-linear bioelectric and bioelectromagnetic signals from cells of the body for potential therapeutic applications that may be more effective than the diverse, artificial types of LFI-EMFs signals. However, the EMOST method is based on the utilization of the non-linear, bioelectric and bioelectromagnetic signals of the patients without any electromagnetic wave modulation or wave inversion of recorded output signals of subjects.

Since each patient with phantom pain has a unique description concerning his/her particular sensations and the pain experienced, and the effects of external electromagnetic fields are related to the type of electromagnetic field applied, it is possible that the treatment of particular phantom pain sensations will require specific method. Our EMOST device may guarantee this specific method, because it is based on the bioelectromagnetic fields of the patients' own living systems.

Phantom pain, neuromatrix theory, representation of body image, visual dreams, redox processes, EMOST treatment

The precise cause of phantom pain is incompletely understood, but most researchers agree that phantom pain and phantom sensations could originate from the central nervous system. LFI-EMFs can affect the length of cell membranes and various membrane-bound receptors as well as free radical and redox processes. During several years of EMOST application, we have found that our method generally affects the quality of sleep and mood in subjects. However, EMOST treatments not only significantly reduced phantom pain, but that most of the patients also reported these additional benefits (mainly about improvement of their sleep and mood quality) after six treatments (Table 1).

Recently, Ikeda et al. (2005) suggested that brain oxidation could be an initial process in sleep induction. They proposed that a mild enhancement of reactive species during wakefulness in the neuronal network that regulates sleep might trigger sleep induction. In other words, reactive species-related redox homeostasis plays an essential role in sleep/wake regulation.

Phantom limb pain can also occur in individuals who are born without limbs. Neurologists have hypothesized that the perception of our limbs can be hard-wired into our brain. According to the neuromatrix theory (Melzack, 1990), the representation of body image is genetically determined and can be modified by sensory input to generate a neurosignature. The regular neurosignature may be responsible for painless phantom limb sensations, whereas phantom pain could be due to an anomalous reorganization of the neuromatrix.

Michael Jouvet (1998) suggested that during sleep, an iteration process occurs at the DNA level that maintains and programs hereditary behavior. His notion may be related to the neuromatrix theory. Namely, during sleep, a neurocomputational process can maintain and reinforce the neurosignature and complex neuro-DNA patterns.

Mulder et al. (2008) reported that a large number of amputees continue to experience a body with all of the limbs intact during in their dreams. The visual perception from the eyes or the imagination generated internally employs the same (or a very similar) neural substrate in the visual cortex (Ganis et al., 2004; Slotnick et al., 2005; Borst and Kosslyn, 2008). In addition, in dream images, deficits occur that correlate with the damaged visual areas of the cortical brain. These phenomena indicate that the same (or a very similar) neural substrate of the visual cortex is used for the visual content of the dream image (Llinas and Pare, 1991). Such findings suggest that during sleep, visual dreams continue and/or reinforce the representation of a missing limb. After a limb has been amputated, the visual system from the eyes recognizes the lack of the limb, but the subconscious proprioceptive system and visual dreams (which are also produced by the subconscious) do not, because the subconscious brain mechanisms (proprioceptive system, neurosignature) have not yet changed.

According to the latest results of Morabito et al. (2010), low frequency and low intensity electromagnetic fields modify the cellular redox state. Thus, it is possible that one of the important effects of the EMOST method (that is based on the non-linear, bioelectromagnetic fields of the subject) is to influence redox processes in cells and tissues. However, reactive species and their derivatives act as fundamental signals (secondary messengers) in physiological (and pathophysiological) processes and are particularly important in redox signal systems. During EMOST treatments, the feedback of non-linear, extra weak electromagnetic could strengthen the cellular redox communication between cells and can influence the redox balance of the entire body via the circulating blood. One outcome of these processes is that EMOST affects sleep and mood processes.

There are converging lines of evidence to support the hypothesis that sleep promotes brain plasticity. Glutamate is one of the main excitatory neurotransmitters in the visual cortex (Baughman and Gilbert, 1980), and the NMDA glutamate receptor is the most important molecular structure in controlling synaptic plasticity and memory functions. However, redox modulation has been recognized as a fundamental system in the regulation of the NMDA receptor (Bókkon and Antal, 2010; Choi and Lipton, 2000; Aizenman, 1995). In addition, glutamate receptors are reactivated during sleep-associated consolidation processes (Gais et al., 2008). It is possible that some of the important effects of the EMOST method are achieved via the redox balance of the body and redox-related plasticity during sleep.

In addition, weak magnetic fields with an optimal frequency and intensity have ameliorating effects on melatonin-related diseases (Persinger, 2006). However, melatonin is involved in the regulation of sleep, and can modulate hippocampus NMDA receptors, as well as brain and blood oxidative stress levels in ovariectomized rats. Furthermore, melatonin improves the antioxidant status (balance of the oxidant-antioxidant status) in the brain and liver (Subramanian et al., 2007; Dilek et al., 2010). According to Huse et al. (2001), opioids are effective in the treatment of phantom limb pain and may influence the cortical reorganization. Del Seppia et al. (2007) reported that non-ionizing electromagnetic fields could affect the nociceptive sensitivity and analgesia via opioid-mediated responses. Recently, Cuccurazzu et al. (2010) showed that extremely low-frequency electromagnetic fields can enhance the hippocampal neurogenesis in C57BL/6 mice.

Summary

We presented our preliminary results regarding the effectiveness of the EMOST method (which utilizes the non-linear, electromagnetic fields of the subjects) for the reduction of phantom limb pain under clinical circumstances. Because LFI-EMFs may affect cell membranes, membrane-bound receptors and free radical and redox processes, the cell type-specific redox status is likely responsible for the effects of various LFI-EMFs. Therefore, the EMOST method potentially can affect redox processes. For the reasons that redox homeostasis plays a fundamental role in physiological/ pathophysiological processes and sleep/wake regulation, and the brain oxidation can be an initial process in sleep induction, and also because sleep promotes the brain plasticity, we hypothesize that some possible effects of EMOST improve redox and redox-related plasticity (*reorganization*).

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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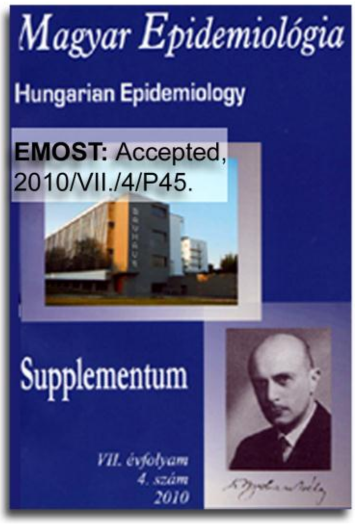
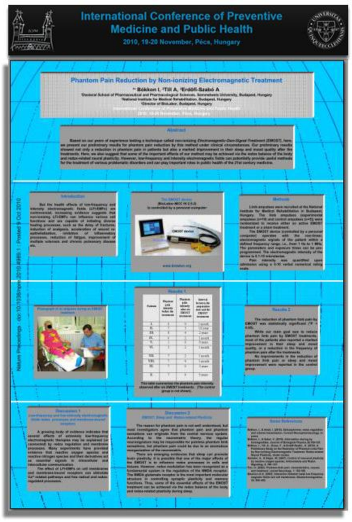
FIGURE 5 Treatments of amputees by EMOST in the clinic. *(A.Erdőfi-Szabó and I.Bókkon)*





Phantom Pain Reduction by Non-ionizing Electromagnetic Treatment

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2010

Abstract

While the health effects of low-frequency and intensity electromagnetic fields are controversial, an increasing body of evidence suggests that non-ionizing and low-frequency electromagnetic fields are capable of initiating various healing processes, such as the delay of fractures, induction of analgesia, inhibition of inflammatory processes, acceleration of wound re-epithelialization, decrease of fatigue, improvement of multiple sclerosis and chronic pulmonary disease, among others. Based on our years of experience testing a technique called non-ionizing *Electromagnetic-Own-Signal-Treatment*, here, we report the preliminary results for phantom pain reduction by this method under clinical circumstances. Our preliminary results showed not only a reduction in phantom pain in patients but also a marked improvement in their sleep and mood quality after the treatments. Here, we also suggest that some of the important effects of our method may be achieved via the redox balance of the body and redox-related neural plasticity. However, low-frequency and intensity electromagnetic fields can potentially provide useful methods for the treatment of diverse problematic disorders and can play important roles in public health of the 21st century medicine.

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24-25. 11. 2011. National Medical Academy, KIEV, UKRAINE методами рефлексотерапії сімейними лікарями дозволить підвищити якість надання медичної допомоги на етапі ПМСД. Передбачається, що дану програму буде розроблено та затверджено в кінці 2011 – на початку 2012 рр. і в II-III кварталі 2012 р. буде можливо розпочати підготовку сімейних лікарів по програмі даних циклів. Лікарі, які після проходження даних циклів виявлять бажання глибше вивчити теорію і практику рефлексотерапії, мають змогу пройти навчання на циклі «Спеціалізація з рефлексотерапії», програма якого розрахована на 3 місяці.

МЕТОД «EMOST» ELECTROMAGNETIC-OWN-SIGNAL-TREATMENT

Dr. Erdőfi-Szabó Attila PhD., Dr. Bókkon István PhD

(м. Будапешт, Угорщина)

ООО «BioLabor» по биофизическим и лабораторным услугам (Венгрия) и ООО «EMOST Nano-MED» по инновациям и производству медицинского оборудования (Венгрия) являются стратегическими партнерами Агентства регионального развития и международного сотрудничества «Закарпатья» (Валерий Грищенко/Erdőfi-Szabó Attila от 29.07.2011.). Целью сотрудничества являются проведение совместных украинско-венгерских исследований и развитие услуг в сфере обслуживания посттравматического стресса, перебоев со сном, аллергии, инконтиненции, реабилитации, аддикции, спортивного и детского здравоохранения.

ПРОФЕССИОНАЛЬНЫЕ УСПЕХИ

37 статьей, 150 ссылок о методе, участие в качестве ведущего в 11-ти клинических исследованиях, опубликованы 5 научных статьей в авторитетных медицинских журналах (см. ниже), за семь лет проведены более 600 профессиональных курсов по ПК, прочтены более 80 научных лекций.

РЕФЕРЕНЦИИ (с 2005 г., в 68 франшизных точках, смотри веб-сайт: www.biolabor.hu)

В рамках нашей системы работают 37 врачей, 45 специалистов натуральной медицины и 135 ассистентов на франшизных точках. С 2005 г. мы имеем более чем 40.000 довольных клиентов.

МЕТОД

Наш организм каждый день восстанавливает самого себя, вечером мы ложимся уставшим, а утром благодаря чему-то встаём «отдохнувшими», хотя мы не вводили дополнительную энергию. От чего это? Мы именно этим биологическим процессом занимаемся.Электромагнитные лучи, исходящие из Солнца в виде света и тепла обеспечивают основные условия жизни флоре и фауне. Электромагнитная энергия является основным условием Жизни, она лежит в основе молекулярных связей, поэтому надо было бы предполагать, что процедуры с электромагнитным методом не альтернативные, а может быть универсальные способы лечения. Разработанным специалистами ООО «BioLabor» методом упорядочиваются собственные электрические и электромагнитные сигналы организма способом рефлексотерапии. Принимаются различного ритма и различной динамики потенциалы клиента, потом они аналоговым образом в определенных вариациях ослабляются и/или усиливаются и возвращаются в организм клиента. Именно такие, расширенные вариации потенциалов делают возможным их влияние на акционный потенциал, а таким образом, упорядочивание процессов на уровне молекул и клеток. Вариации потенциалов с определенной индикацией через поверхность кожи, расположенные в коже свободные нервные окончания, рецепторы и эффекторы, сосудистую систему, клетки Меркеля, иммунные клетки окажут непосредственное воздействие на центральную нервную систему, вегетативное симпатическое и парасимпатическое регулирование, иммунитет и информационную систему. Имеется возможность применения метода в электро-акупунктуре на стимуляцию, которая основана на собственных сигналах, этим достигается согласование взаимоотношений качеств потенциалов, осуществляющихся в данной зоне. Дальнейшим преимуществом является и то, что электрические потенциалы и нефизические моменты врача, осуществляющего терапию, остаются независимыми от клиента, что для обеих сторон предоставляет безопасность. Изменения происходят главным образом через окислительно-восстановительные процессы и точное регулирование нейротрансмиттерами. Вероятность появления побочных эффектов довольно маленькая из-за наличия рефрактерной фазы, уровень риска низкий, поскольку сигналы собственные, практически исключена перегрузка организма благодаря собственному уровню сигнала, а при их применении вместо риска интерференции искусственных (дигитализованных) электромагнитных сигналов имеется соответствующая, естественная когеренция. С этим методом можно работать с взаимосвязанными сигналами одновременно, поэтому имеется возможность сохранить их естественную взаимосвязь. С этим методом развиваются саморегуляция процессов, учебные и восстановительные способности организма. Благодаря тому, что на протяжении нескольких лет у нас приобретался благоприятный опыт по применению метода, стало возможным в некоторых областях регулярно им пользоваться. Кроме повседневного применения по некоторым направлениям, наш метод доказал своё право на существование так и в условиях стихийных бедствий, как и в особых военных условиях. Считается преимуществом метода и то, что требуется относительно малое количество процедур (4-6) и его эффект продолжительный.

ГЛАВНЫЕ ПРОЕКТЫ И РЕЗУЛЬТАТЫ

Разработка медицинских терапий

2005.г.: Центральная нервная система, нейровегетативная система; Настроение, концентрация, вялость; Нейротрансмиттерные процессы;

2006.г.: Ортомолекулярный и метаболический баланс; Педиатрия, лактозная и глютеновая интолерантность; Кооперация сосуд, почек и сердца; Аллергия, качество сна, инконтиненция; Психо-нейроиммунология и её взаимоотношения, стресс и болезни

2007.г.: Когнитивные функции;

2008.г.: Природные бедствия, посттравматический стресс; Фантомные боли после ампутаций; Детские процедуры, рост, развитие, социализация; Чрезвычайные ситуации, физический стресс и психические травмы в армии.

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ЭЛЕКТРОМАГНИТНАЯ РЕФЛЕКСОТЕРАПИЯ

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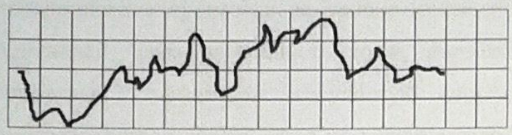
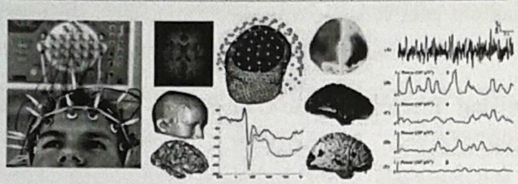
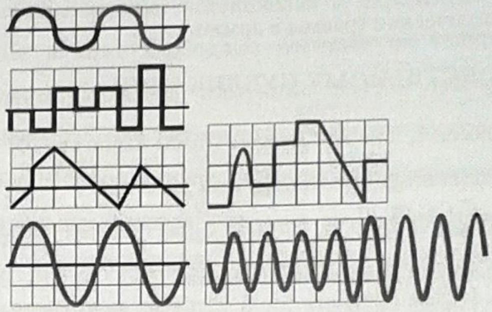
Образ естественных сигналов (потенциалов)

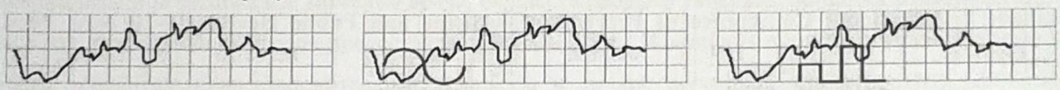


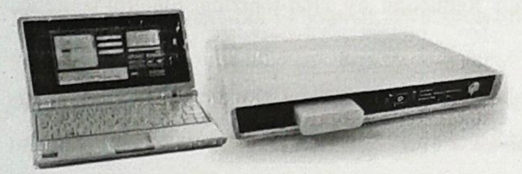


Образы искусственных ЭМ сигналов



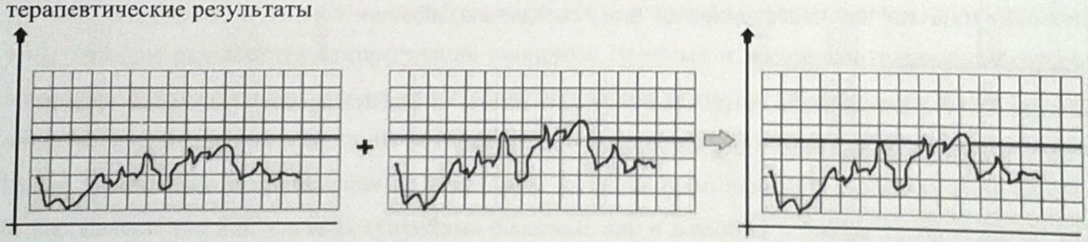
Относительно низкая результативность искусственных импульсов





BIOLABOR Emost Redox 1.1

Восприятие, расширение, возвращение вариаций естественных сигналов имеют лучшие терапевтические результаты



Лечение с собственным электромагнитным сигналом (Electromagnetic-Own-Signal-Treatment т.е. метод «EMOST») означает ощущение и систематическое, расширенное возвращение экстремально низкоинтенсивных биоэлектрических и биоэлектромагнитных излучений (биопотенциалов) человеческого организма. Этот метод путём возвращения организму через поверхность кожи системы биологических сигналов годен к изменению силы биоэлектрических сигналов организма и к оказанию воздействия на биологические процессы биохимическим путём, к точному регулированию органов. Метод «EMOST» через ослабленные и нежно усиленные сигналы (потенциалы) способен достичь точного регулирования акционных потенциалов, изменить их подпороговые и надпороговые свойства, которые влияют на функционирование наших органов, усвоение питательных веществ, выделение гормонов, и иммунную систему.

Testing the EMOST, result: the patient is sleeping (!) in noisy classroom (!), no pains (!), only well-experience.

EMOST™ biophysical treatments to reduce the risk of aggressive behaviour in prisons

Biophysical electromagnetic managements

by István Bókkon
2013

EMOST Redox 1.1 Medical Device (Certificate: HU11/6192) controlled by a personal computer.

1. Background

1.1. Prisoners

Testosterone, norepinephrine, serotonin, glucose metabolism, and the aggression

Many studies on testosterone activity show a relation between high plasma levels and a tendency towards aggression. It was suggested that the interaction between low serotonin and high testosterone concentrations in the central nervous system has an important effect on the neural mechanisms involved in the expression of aggressive behavior. It seems that testosterone modulates serotonergic receptor activity that directly affects aggression, fear and anxiety. In addition, violent criminals have abnormalities in their glucose metabolism as indicated by decreased glucose uptake in their prefrontal cortex and a low blood glucose nadir in the glucose tolerance test. Low non-oxidative metabolism can be a crucial component in the pathophysiology of habitually violent behavior among subjects with antisocial personality disorder. The level of norepinephrine is also higher in aggressive prisoners than in moderately aggressive jailed inmates, which suggests a pronounced role of norepinephrine in the formation the aggressive behavior.

Sleep problems and aggression

Clinical studies revealed that sleep problems can be a contributory factor in the development of reactive aggression and violence. It seems that the relation between sleep problems and aggression can be mediated by the negative effect of sleep loss on prefrontal cortical working, namely the loss of control over emotions, including loss of the regulation of aggressive impulses to context- appropriate behavior. In addition, other potential contributing mechanisms connecting sleep problems to aggression and violence are most likely found within the central serotonergic and the hypothalamic-pituitary-adrenal-axis. Individual variation within these neurobiological systems may be responsible for amplified aggressive responses induced by sleep loss in certain individuals. Recent studies revealed that prisoners have higher levels of anxiety, sleep problems and depression than the general population.

Prefrontal malfunctions and aggression

Numerous researchers suggested that the relationship between prefrontal malfunctions and the likelihood of acting aggressively is mediated by the failure to adaptively use that we called the ‘‘executive cognitive functions’’. Executive functioning allows people to respond to situations in a flexible manner, to make and adapt plans, and to base their behavior on internally held ideas rather than being governed solely by external stimuli. There are neuroimaging data that the prefrontal cortex plays an important function in the successful identification of facial expressions of emotion. The medial prefrontal cortex is most consistently activated by emotional stimuli, suggesting it has an essential role in emotional processing. Recent *Transcranial magnetic stimulation* (TMS) experiments also support the hypothesis of inhibition deficits and frontal cortex dysfunction in violent offenders when compared with non-violent control subjects. These prefrontal structural and biochemical malfunctions can cause the low arousal, poor fear conditioning, lack of conscience, and decision-making deficits that predispose to antisocial and psychopathic behavior. It is very possible that many aggressive behaviors come about mainly automatically, emotionally, and through conditioned association with other stimuli.

1.2. Prison officers and the burnout

Prison officers are exposed to special and very powerful stressors. The effects of this dangerous work on mental health are complex. WHO (2005) is predicting that by 2020, stress can be a major cause of workplace ill health. It is well known that prolonged or intense stress can have a negative impact on an individual’s mental and physical health. Workers who are stressed are also more likely to be unhealthy, poorly motivated, less productive and less safe at work (WHO, 2003).

Prison officers are among the most stressful of all occupations. The risk of suicide among prison guards is 39% higher than the rest of the working age population. Prison officers - compared to the general population - have been found to have significantly lower life spans and higher rates of alcoholism, suicide, heart attacks, ulcers, and hypertension. Nowadays, officers have a high level of responsibility for the care, safety, security and rehabilitation of prisoners. In addition, there are large individual differences in the response to stress i.e. two prison officers can react in completely different ways to the same stressor.

Prison officers experience a number of negative feelings and attitudes leading to depleted emotional states (emotional exhaustion) such as burnout. The burnout is a tendency toward depersonalization, which occurs as employees become frustrated with their job and less concerned for their clients and results in increasingly negative work related attitudes. Maslach's model of burnout characterizes emotional exhaustion as depletion of emotional energy and a feeling that one's emotional resources are inadequate to deal with the situation.

2. EMOST (Electro-Magnetic-Own-Signal-Treatment) treatments

EMOST method and natural-based low-frequency and intensity electromagnetic signals

There has been increasing evidence about the health-promoting outcomes of low-frequency and intensity electromagnetic fields (LFI-EMFs) that are able to initiate different healing processes. EMOST medical device can detect non-linear, low-frequency and intensity bioelectric and bioelectromagnetic signals (as ECG or EEG signals) from subjects' skin by unique flat input/output electrodes. The collected signals are processed by computer of EMOST apparatus. The subjects are treated by processed signals originated from apparatus (signal density between 1 Hz - 1 MHz; intensity range is in natural pA mV). A particular feature of EMOST method - compared to most of electromagnetic equipments - is that the subjects' own bioelectro- bioelectromagnetic signals that are detected from skin can be processed in natural analogue mode (non-digitalized). The special analogous process makes it possible that the biophysical information content of detected and back-transmitted electro-electromagnetic signal is much larger than in digitized methods (Figure 1). Next, analogue signals are radiated back, using a flat electrode radiator through various signal density/signal combinations, with some signal amplification (-20dB- +60dB), to the skin's surface on the opposite side and extended by the higher range sounds of the signal (Figure 2).

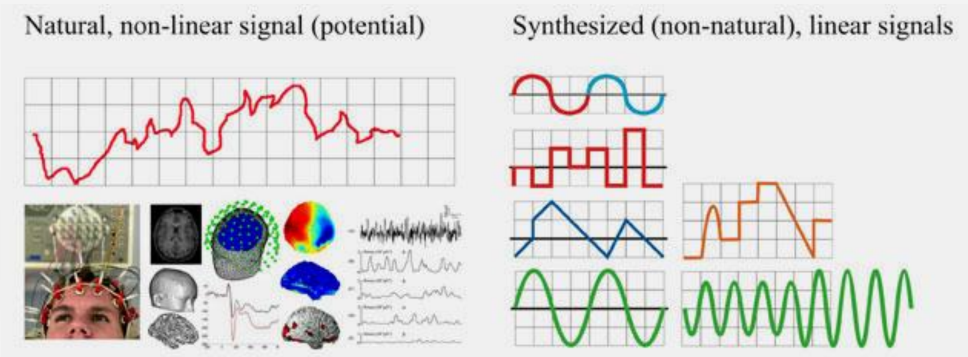


Figure 1. Differences of natural and synthesized (digilatized) signals, or impulses

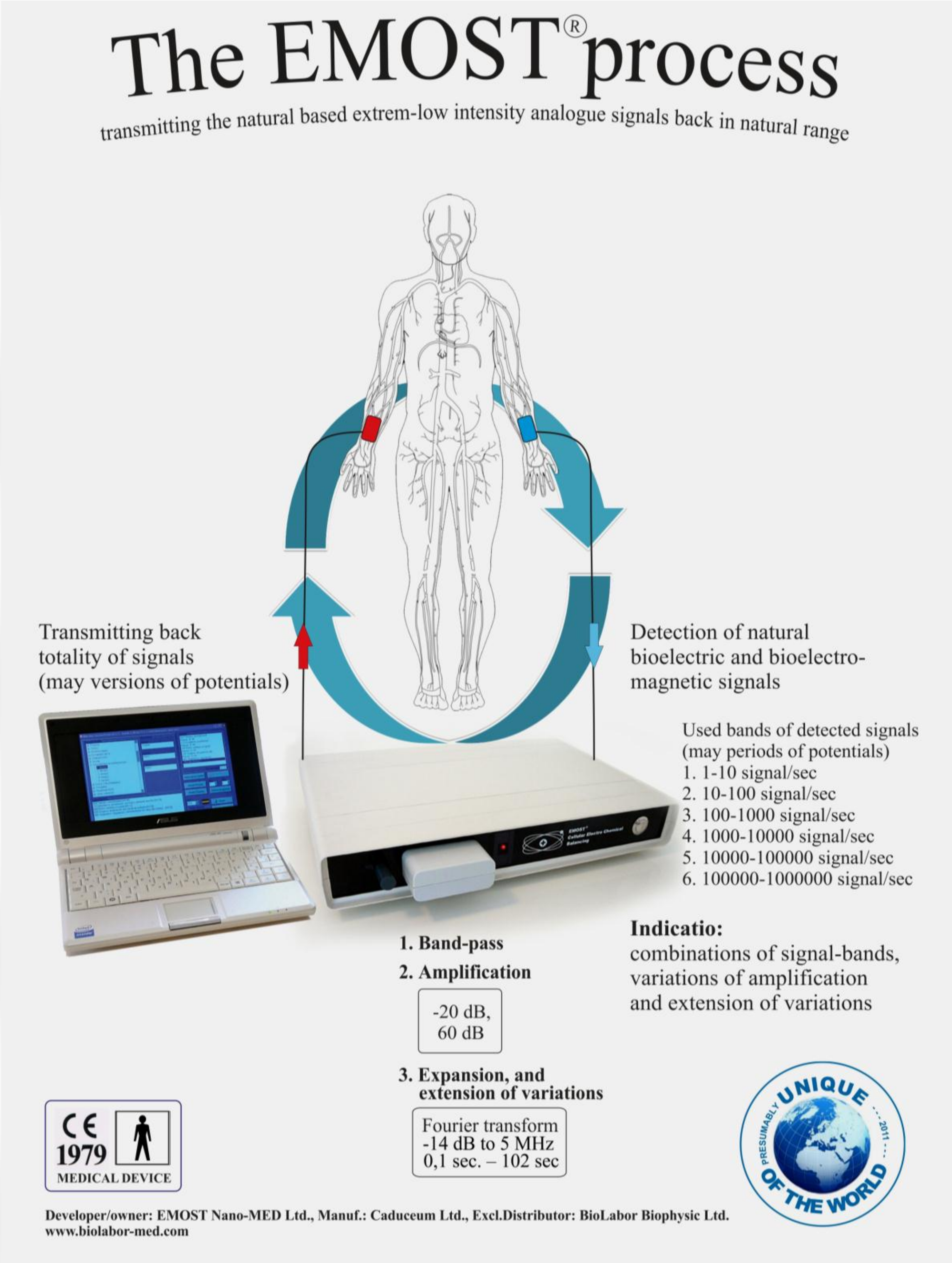


Figure 2. The EMOST process

EMOST method exerts its effect through the skin associated autonomous nervous system

The innervated skin is an incredible complex system and the largest organ of the body with numerous very important functions that is linked to the peripheral sensory nervous system (PNS), the autonomous nervous system (ANS), and the central nervous system (CNS). There is growing evidence that the cutaneous peripheral nervous system has essential roles in skin homeostasis as well as in diseases. Cutaneous nerves can react to stimuli from the circulation and to emotions. There is evidence that autonomic nervous system serves as a major component in the emotion response. Moreover, the central nervous system is directly (through efferent nerves or CNS-derived mediators) or indirectly (through the adrenal glands or immune cells) linked to skin functions (Figure 3). It suggests that skin, as our largest organ, can represent stress related conscious and unconscious emotions directly by efferent nerves and mediators from CNS or indirectly by the adrenal glands or immune cells. The represented stress related conscious and unconscious emotions can affect on biochemical, bioelectrical and bioelectromagnetic patterns. It is very probable that EMOST method exerts its major effect through the skin associated autonomous nervous system (ANS), which offers a unique therapy for the treatment of a numbers of different disorders. EMOST exposition can modulate biochemical, bioelectrical, and bioelectromagnetic processes in the skin, and the modulated skin signals can affect the neuroendocrine system and modulate brain activity through ANS.

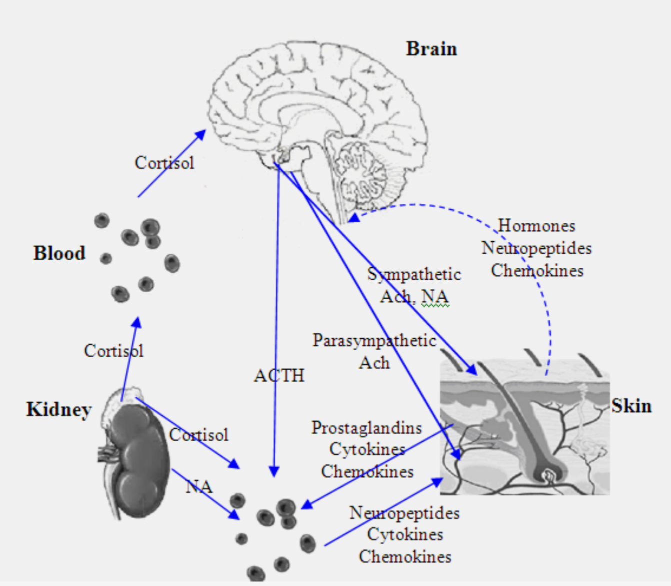


Figure 3. Shematic illustration about complex communication between skin cells and the nervous system.
Ach =acetylcholine, NA=noradrenaline, ACTH= Adrenocorticotropic hormone.

Why should be applied the EMOST method for prison officers and prisoners in prisons?

Our many years experience indicated (that we have published in academic journals) the efficiency of EMOST treatments for improve mental and physical states, i.e. stress reduction, sleep problems, improved mood, increased concentration ability, among them. The EMOST method has also been applied successfully to reduce stress under catastrophic conditions for many subjects (Figure 4). We also reported some preliminary experiments regarding the effectiveness of single EMOST treatment on some stress related serum parameters such as uric acid, albumin, cortisol, C-reactive protein etc. As we could see above, sleep and stress (aggression) are central problems under prison conditions. The systematic and routine application of EMOST treatment is not only able to reduce aggression, but also able to maintain overall health in prisons. Finally, the application of EMOST in prisons can produce significant cost saving and improve general health conditions.

Figure 4. In June, 2010 the biggest flood hit Felsőzsolca, in Hungary. Our photos have been taken in Felsőzsolca. (A) EMOST treatments of exhausted and stressed local residents, soldiers, firefighters. (B) Our car and local residents in a flooded street in Felsőzsolca, on June. 2010. (C) Residents used a boat to cross a flooded street in Felsőzsolca.

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