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Changeability of tissue's magnetic remanence after galvanic-magnetostimulation in upper-back pain treatment

Andrzej Jan Dyszkiewicz [a,b,c,*], Paweł Kępiński [a,d], Paweł Połeć [a,d], Damian Chachulski [a,d], Ewa Nowak-Kostrzewska [a,d]

[a] *Laboratory of Biotechnology "LABIOT", Cieszyn, Poland*
[b] *Higher School of Information Technology, Katowice, Poland*
[c] *Silesian Higher Medical School, Katowice, Poland*
[d] *University of Silesia, Katowice, Poland*

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ABSTRACT

Objective: Research was conducted on parametric profiles of healthy subjects and patients with cervico-brachial pain syndrome resulting from C4/5 and/or C5/6 discopathy, including magnetic remanence of tissues in marker points 1-12 (L+R) and functional parameters, and their subsequent change after treatment in group A, using method of push-pull galvanic magnetostimulation (GMT 2.0).
Design: GMT 2.0 device, comprised of one air solenoid and three galvanic solenoids in electrolytic tubs, was designed for push-pull magnetostimulation of the head, coupled with simultaneous stimulation of the limbs.
Setting: Clinical trial was conducted in Outpatient Private Clinic "VIS" under the auspices of Silesian Higher Medical School in Katowice, Poland.
Patients: 55 subjects participated in the study: control group K consisted of 23 healthy individuals, whereas 33 patients in group A were treated using GMT 2.0.
Intervention: Only patients in group A were treated with GMT 2.0 during 40-min sessions over a period of 10 days.
Main outcome measures: Parametric profile of the patients was defined using various measurements: electronic SFTR test (C-Th-shoulders), HR, RR, BDI and VAS tests, magnetic remanence in marker points 1-12 (L+R) and blood parameters: HB, ER, CREA, BIL, K^+, Na^+, Cl^- Fe^{2+}, Ca^{2+} and Mg^{2+}.
Results: There was a significant reduction in pain (VAS), increase in the range of motion (SFTR), lower depression symptoms (BDI), slower heart rate (HR), lower blood pressure (RR), greater concentration of Mg^{2+}, K^+, Ca^{2+}ions and reduction in the concentration of BIL, CREA Fe^{2+} after GMT 2.0 treatment in group A. Evaluation of magnetic remanence in marker points M1-12 (L+R) initially showed higher values in group K, which after treatment were normalized to values similar to those in group K.
Conclusion: GMT 2.0 treatment in group A resulted in normalization of magnetic remanence, synergically with increased range of motion (SFTR test), decreased HR and RR parameters, smaller depressive trends (BDI test), as well as increased ion levels (K^+, Mg^{2+}, Ca^{2+}) and better functional parameters of kidneys and liver.

Contents

* Correspondence to: Department of Biotechnology, Laboratory of Biotechnology "LABIOT", Goździków 2, 43-400 Cieszyn, Poland.

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1. Introduction

The arms and the cervical spine, thanks to their complex range of motion, form one of the finest movement systems in the human body. They allow the individual to explore the surrounding environment by means of telereceptors and touch. They also provide people with the tools needed to shape the environment. Structurally, the cervical spine meets the requirements for perception and directional communication, providing the head with a wide range of active mobility in three planes and the hands with the highest number of degrees of freedom, a feature found only in primates. The complexity of this structure is a source of a number of conflicts, which mainly include disc-radicular and disc-vascular conflict, as failure of a single link in the system causes direct or indirect motor function disorder of the entire complex [1].

2. Area of clinical observation

The cervical spine plays an important role in the protection of the cervical blood vessels, the spinal cord and the nerve segments, especially during the execution of individual motor behaviours. The concentration of a large number of critical structures in the immediate vicinity of the spine means that small functional and anatomic changes in its structure have a direct impact on the vessels and sensorimotor nerves. These changes can also have a modifying effect by altering the functions of other organs such as the brain, the labyrinth, heart, lungs, and even the kidneys or liver. This is also reflected in the symptomatology of cervico-brachial syndromes caused mostly by disc-radicular conflict in the C4/5–C5/6 segments (Fig. 1a) where, apart from the pain and the dysfunction of the spine and upper limbs (Fig. 1b) [2], balance issues begin to appear (including abnormal heart rates and systolic-diastolic pressure). Disc-radicular conflicts, originally a consequence of functional changes (instability of the segment), lead to permanent anatomical changes resulting in long-lasting conflict with axial (sensorimotor) innervations [3], as well as autonomous innervations, causing vascular issues and disorders of distant organs, such as the heart, brain, lungs, labyrinth, liver and kidneys. As such, the syndrome affects many organs and poses a serious metrological and therapeutic challenge [4].

3. Functional parameters

Many years of attempts to quantify the parameters of pathology in disc-radicular conflicts ([5–7] e.g. in cervico-brachial syndromes), have encountered a number of difficulties associated with the need to transform the facts described by means of medical language into strict mathematical and parametric formulas [8,9]. Initially, indirect, semi-quantitative methods were used, based on a subjective and numeric classification of disease characteristics, for example, by using numeric scales of quality of life (e.g. Rolland-Morris), the VAS pain scale, BDI tests and other [10–12].

The SFTR scale is successfully used in instrumental studies. Initially, it was carried out by using hand-held goniometric tools, whereas now, automated inclinometric systems are being used [13] and their correlation with survey tests [14–17].

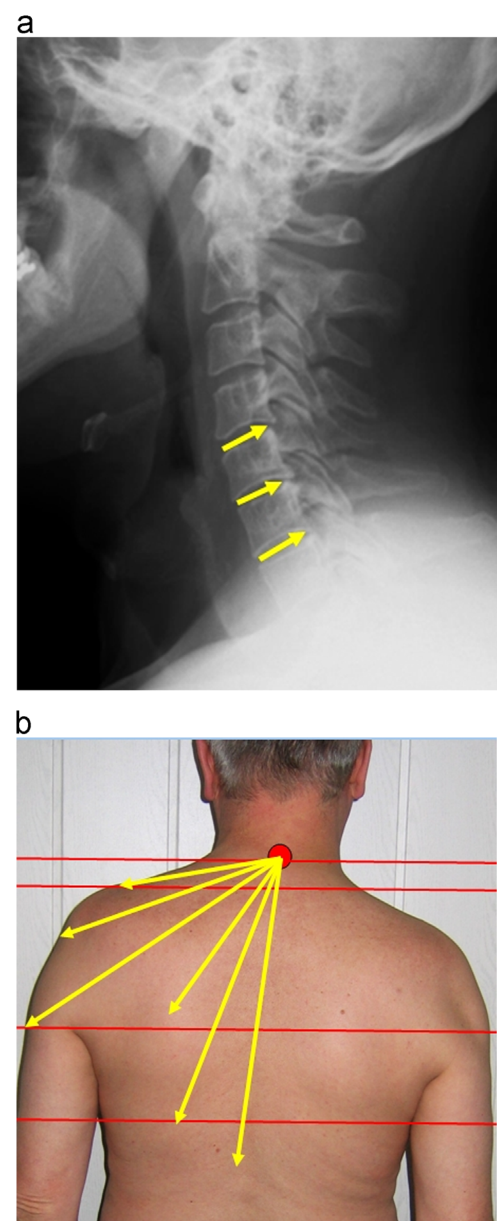

Fig. 1. Cervicobrachial Syndrome: (a) advanced degenerative changes in areas $C_{4/5,5/6,6/7}$, (b) scoliosis reflectorica C/Th with asymmetric profile of muscle tone.