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Therapeutic Effects of Superinductive Magnetic Filed on Low Back Pain

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Abstract: Low back pain is one of the major public health problems, with approximately 1 in 3 adults experiencing an episode of low back pain during their lifetime. The aim of this study was to evaluate the effect on pain and physical function of a therapeutic protocol including analgesic electrotherapy, lumbar deconstrictor manual therapy and kinetic therapy and the superinductive magnetic field therapy. Patients were divided into two groups of 20 and 20 respectively. Group 1 was treated with the conventional protocol, while the second group received in adition the superinductive magnetic field therapy. Pain was assessed by VAS scale at admission and every 2 days, and functional deficit was assessed by the Fingertips to floor (FTF) test at admission, at 6 days and at discharge at 12 days. The Activities of Daily Living (ADL) scale was also used to assess physical function at admission and discharge. 40 patients (24 female, 16 male), average age 61 years (± 5.7), average BMI of 32.11± 7.38 SD, kg participated and their data were analyzed. An average percentage decrease in VAS was noticed after the 12 days of treatment of 67% for group1 and of 88% for group 2. The deficit in FTF was also better in group 2 (FTF= 16+5cm) compared to FTF=22+3 in the control group. On ADL assessment, no significant differences were noted. Superinductive magnetic field therapy is effective in the treatment of low back pain relieving pain syndrome and improving physical function.

Keywords: Superinductive magnetic field 1; Low back pain 2; SIS 3; Magnetic fileld therapy 4; functional improvement 5; (List three to ten pertinent keywords specific to the article yet reasonably common within the subject discipline.)

1. Introduction

Low back pain is one of the major public health problems, with about one in 3 adults experiencing an episode of low back pain in their lifetime. Globally, years lived with disability caused by low back pain increased by 54% between 1990 and 2015, mainly because of population increase and ageing, with the biggest increase seen in low-income and middle-income countries. Low back pain is now the leading cause of disability worldwide. [1]

In the era of modern medicine and pain management, the exploration of alternative and complementary therapies has gained significant attention. Magnetic fields [2] have emerged as a promising approach to addressing chronic pain and enhancing the body's natural healing processes. The superinductive magnetic fields (SIS) [3] and electrical

stimulation [4] have demonstrated the potential to modulate cellular activities and promote tissue regeneration, which could have profound implications for pain relief. Recent studies have investigated the impact of magnetic fields on various aspects of pain management and investigated the efficacy of magnetic field therapy in the treatment of chronic low back pain.[5][6]

These findings suggest that the interaction between external electromagnetic fields and the body's intrinsic electrical systems can influence the movement and behavior of cells involved in wound healing, potentially accelerating the recovery process. The aplication of the superinductive magnetic fields has also been shown to have a significant effect in inhibiting severe pain caused by a variety of conditions [7][4].

The superinductive magnetic fields act on the body's electrical systems and can influence the activity of cells involved in the pain response and tissue repair. These fields may affect ion channels, neurotransmitter release, and other cellular processes that contribute to pain perception and inflammation [8] [9] [6] [10]. However, the specific mechanisms by which magnetic fields exert their analgesic effects remain an area of active research. [9] [10] [6] [8]

2. Methodology

2.1Objective: Our study aimes to investigate the effect on pain and physical function of a therapeutic protocol that includes electrotherapy, manual therapy, kinesiotherapy and superinductive magnetic field therapy.

2.2.Participants: Patients diagnosed with acute or chronic low back pain, or who complained of low back pain as a major symptom, were considered. A total of 50 patients were included in the study. All forms of low back pain were considered eligible for treatment and enrollment in the study, regardless of the etiology, pathological and physiological mechanisms underlying the condition or origin, with the mention that the therapeutic plan was drawn up and applied according to the stage of the condition. All of the participants signed an informed consent.

2.3.Exclusion criteria: The following types of patients considered eligible were not enrolled in the study: Patients who have absolute and relative contraindications for SIS treatment such as electronic implants, metal implants, pregnancy, application in the area of an epiphyseal plate, coagulopathies, anticoagulant background medication, cancer, fever and patients who are already using an SIS treatment or with indications for it but who present another condition or symptom considered a priority, having a different therapeutic protocol for its management.

2.4.Intervention: The study consisted of a 6-week treatment program that combined several therapeutic modalities: electrotherapy with interferential currents, manual therapy techniques, kinesiotherapy and superinductive magnetic field therapy. The developed clinical trial is an experimental, randomized, non-blind, therapeutic study. The patients were divided into two groups of 20 and 20 patients, respectively. The first group followed a standard protocol of conventional physiokinetotherapeutic treatment (analgesic electrotherapy: Transcutaneous electrical nerve stimulation (TENS), manual therapy, lumbar manual massage therapy and progressive kinesiotherapy: Williams program 1, 2 and 3 in line with the acute or chronic phase). Aditionally to the second group SIS therapy was added in addition to the standard protocol.

2.5.Design: Participants were randomly assigned to one of the two groups: the first group received a conventional treatment protocol, while the second group received a protocol that included superinductive magnetic field therapy. For the magnetic field, the pathology was taken into account, so acute and subacute problems were treated with a frequency between 60-150 Hz, and chronic ones with a frequency of up to 10 Hz,

the flux density at a maximum of 2.5 Tesla. Treatment was provided 3 times a week for 3 weeks.

2.6.Assesments: Pain intensity was measured using the Visual Analogue Scale at admission and every 2 days. Functional status and deficit was assessed by the finger to floor index (FIF) at admission, at 6 days and at discharge at 12 days. The Assessment of Activities of Daily Living (ADL) scale was also used to assess physical function at admission and discharge.

2.7.Analysis: The data was analyzed using SPSS. Descriptive statistics, paired t-test, and ANOVA tests were performed to evaluate the outcomes.

3. Results

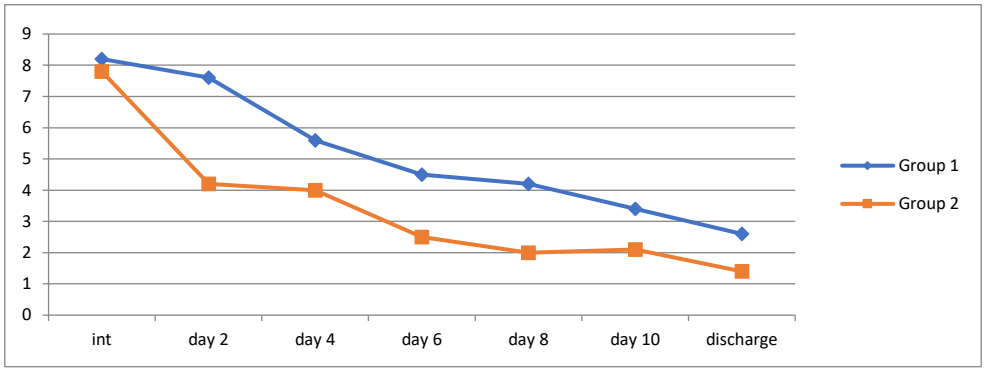
40 patients (24 female, 16 male), mean age 61 years (± 5.7), mean BMI of 32.11± 7.38 SD, kg, rural (65%) and urban environment participated in the study and these data were analyzed, presented in the table below.

Table 1. Demographycs of the study group

		Group			
		1		Group 2	
Age	• 50 - 60	• 7	• 33 %	• 6	• 31%
	• 60 - 70	• 9	• 46 %	• 10	• 50%
	• 70 - 80	• 4	• 21 %	• 4	• 19%
IMC	• < 18,5	• 2	• 10%	• 1	• 5%
	• 18,5 - 24,9	• 3	• 15%	• 3	• 15%
	• 25 - 29,9	• 6	• 30%	• 6	• 30%
	• > 30,0	• 8	• 45%	• 10	• 50%
Sex	Male	• 5	• 20%	• 7	• 33%
	Female	• 15	• 80%	• 13	• 66%
Enviromen t	Rural	• 12	• 55%	• 10	• 50%
	Urban	• 8	• 45%	• 10	• 50%
Risc of fall	Low (TUG <12s) 6 33,3	• 7	• 33%	• 15	• 80%
	High (TUG >12s) 12 66,6	• 13	• 66%	• 5	• 20%

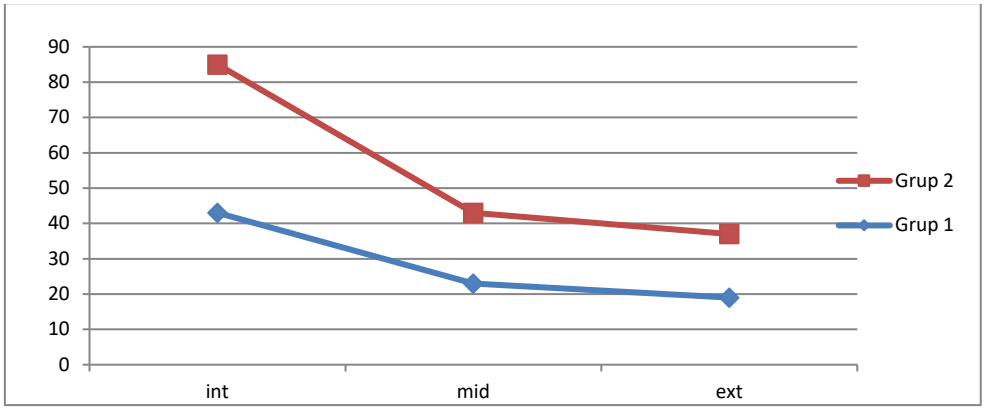
Overall, we can speak of an average percentage decrease in VAS after the 12 days of treatment of 67% for those who followed standard therapy and 88% for patients who had additional therapy sessions with the superinductive system, with an improvement on the VAS scale from the first evaluation (VAS decrease 3±1) compared to the control group (VAS decrease 1±1) ($p<0.001$)

Figure 1. VAS evolution.



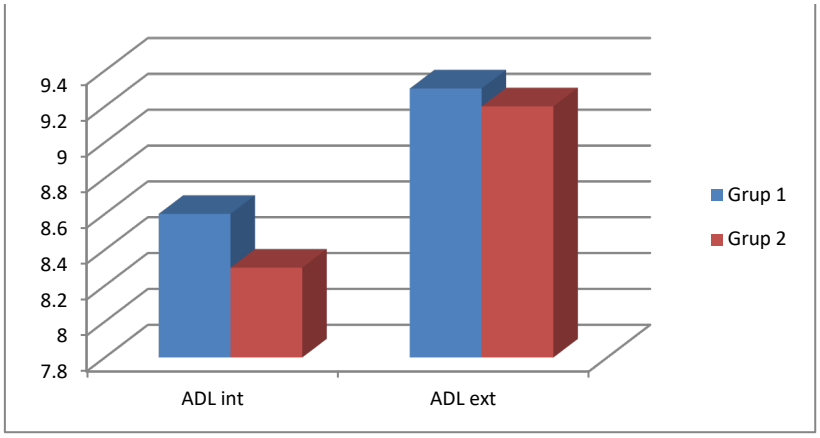
The finger to floor (FIF) test was also better in group 2 (FIF= 16±5cm) compared to FIF=22±3 in the control group. ($p<0.005$)

Figure 2. FIF evolution



The activities of daily living on ADL showed no significant differences were noted between the 2 groups. (p=0.010)

Figure 3: ADL Evolution



4. Discussion

Magnetic fields have been studied recently in the context of low back pain[11][12], as well as other conditions involving pain and impaired physical function in different other applications of this therapies. [13]

The results of our study suggest that the addition of SIS therapy to a comprehensive rehabilitation protocol can significantly improve pain relief and functional outcomes in patients with chronic low back pain. Our findings align with previous research demonstrating the potential for pulsed electromagnetic field therapy and micro current stimulation to alleviate chronic pain conditions through modulation of the body's electrical systems and cellular processes involved in pain perception and tissue repair. [14][15] Pain relief was noticed after the first session with the SIS treatment, a decrease of VAS being noticed to 50%, patients expressing verbally the satisfaction after the first session.

Overall, these results also indicate that the integration of SIS therapy as part of a multimodal rehabilitation approach may provide added benefits for individuals suffering from chronic low back pain. This could be the result of optimizing the body's intrinsic electrical signaling, which would be is consistent with findings from other studies highlighting the potential analgesic effects of electromagnetic field interventions [16] [14] [10].

Larger, sham-controlled studies would be needed to further elucidate the efficacy and mechanisms of this promising therapeutic approach [12] [10].

Also, the improvement in the deficit evaluated by FIF erection observed in the group receiving SIS therapy may be attributed to the effects of the magnetic field on peripheral nerve function and neuromuscular transmission, leading to enhanced motor and sensory nerve conductivity as shown also in the study of Khoromi et al [12]. The improvement in physical function was also shown in other studies using magnetic field therapy for chronic pain conditions.[17][18][2]

Surprisingly, no significant difference was found between the two groups in the Activities of daily living ADL assessment. This may be due to the relatively short duration of the treatment and follow-up period, or the need for a more sensitive functional outcome measure. Moreover, the baseline ADL scores were relatively high, leaving little room for improvement. However there was a slight improvement also on the ADL on both groups.

Limitations of this study could be considered the relatively small sample size, lack of blinding, and short duration of follow-up. Also, not having patients under 50 years included could be also considered a limitation.

5. Conclusions

Superinductive magnetic field therapy showed to be effective in the treatment of low back pain, regardless of cause and duration, accelerating healing time, remission of pain syndrome and improving physical function. It is desirable that new technologies be studied and applied as much as possible in clinical protocols for the benefit of patients.

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