https://doi.org/10.48047/AFJBS.6.14.2024.5682-5688

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Effect of Combined Low Frequency High Intensity Magnetic Therapy and Cervical Stabilization Exercises on Deep Cervical Muscles Endurance in Cervical Spondylosis

Alzahraa F. Morshed[1], Neveen A. Abdel-Raoof[2], Rania R. Ali[2], Amr Hassan[3], Doaa Rafat Elazab[2]

[1] Department of Basic Sciences, Faculty of Physical Therapy, Delta University for Science and Technology, Gamasa, Egypt
[2] Department of Basic Sciences, Faculty of Physical Therapy, Cairo University, Cairo, Egypt
[3] Department of Neurology, Faculty of Medicine, Cairo University, Cairo, Egypt.

Corresponding author: Alzahraa F. Morshed

Article History

Volume 6, **Issue** 14, 2024

Received: 29 June 2024

Accepted: 12 August 2024

doi: 10.48047/AFJBS.6.14.2024.5682-5688

Abstract:

Introduction: Cervical spondylosis is a neurologic condition that develops insidiously over time as degenerative changes of the spine result in compression of the cord and nearby structures. Electromagnetic fields (EMFs) provide a non-invasive, safe, and easy method to treat pain with respect to musculoskeletal diseases. Stabilization exercises may be an important approach to alleviate neck pain and improve function. **Methods:** Seventy-eight cervical spondylosis patients were represented of the study. The patients were assigned into two equal groups study group (GI) and control group (GII). The patients in study group were treated by low frequency high intensity magnetic therapy in addition to cervical stabilization exercises (CSE). The patients in control group were treated by sham magnetic therapy in addition to, same CSE as study group. Deep flexors endurance, cervical pain and function were measured by stabilizer biofeedback and neck disability index (NDI) respectively. **Results:** significant increase in deep flexors endurance and NDI score in both groups ($P< 0.05$) Post treatment between-groups analysis was as following; no significant difference in deep cervical flexors while, significant increase of NDI score in favor to (GI) ($P< 0.05$). **Conclusion:** Adding the low frequency high intensity magnetic therapy to cervical stabilization exercises has a substantial impact on improvement on pain and disability in cervical spondylosis.

Keywords: cervical stabilization, cervical spondylosis, Pain, NDI

1. Introduction:

Cervical spondylosis (CS) is a chronic degenerative disorder of the cervical spine that manifests with a variety of clinical symptoms, including headaches, neck pain, stiffness, radiating pain, and potential neurological impairments [1]. From an epidemiological perspective, the prevalence of cerebrospinal (CS) conditions exhibits a variation across different age groups, with an incidence

rate of 12.4% observed among individuals aged 18–29, escalating to 100% in those over 70 years of age [2]. This trend signifies a substantial and age-related rise in prevalence. While the early stages of CS may have minimal impact on daily activities, the progression of the condition is associated with exacerbation of symptoms, increased complexity of treatment, and higher healthcare costs. This highlights the critical importance of early detection and intervention [3].

The use of magnetic therapy has seen a significant increase in rehabilitation treatments over the past decade. This approach offers a non-invasive, safe, and convenient method for directly addressing the site of injury, as well as the sources of pain and inflammation. Magnetic field therapy has been employed to promote bone healing, manage osteoarthritis and inflammatory conditions of the musculoskeletal system, alleviate pain, enhance ulcer healing, and reduce spasticity [4].

Recent interest has focused on understanding the effects of cervical stabilizing exercises, not only for the prevention of neck disorders but also for the management of chronic cervical pain. These exercises aim to help cervical vertebrae maintain a neutral position by strengthening deep muscles such as the longus colli and longus capitis, which are crucial for spinal stability. Studies indicate that patients with cervical pain often exhibit reduced strength and endurance in these deep muscles, along with diminished ability to retract the lower jaw, compared to healthy individuals. Additionally, evidence suggests that stabilizing exercises are highly effective in reducing chronic cervical pain and enhancing neck function [5]. The therapeutic potential of combining low-frequency, high-intensity magnetic therapy with cervical stabilization exercises (CSE) for managing cervical spondylosis has not been well established in previous studies. The aim of the current study is to evaluate the effects of adding low-frequency, high-intensity magnetic therapy to CSE on cervical muscle endurance, pain levels, and functional outcomes in patients with cervical spondylosis.

2. Patients and methods

This study was conducted at the outpatient clinic of the Faculty of Physical Therapy, Delta University for Science and Technology, from August 2022 to March 2023. Prior to participation, each patient signed an informed consent form to confirm their understanding and agreement. The study received approval from the Ethical Committee for Clinical Research at the Faculty of Physical Therapy, Cairo University (registration number P.T.REC/012/003846).

The sample comprised 78 patients with cervical spondylosis, who were divided into two equal groups: the study group (GI) and the control group (GII). All patients were clinically diagnosed and referred by a specialist neurologist. Diagnosis was confirmed using X-rays. Participants were aged between 30 and 45 years, of both sexes, and had experienced chronic neck pain for more than three months. Exclusion criteria included a history of cervical trauma, cervical myelopathy, inflammatory arthritis of the cervical spine, tumors or infections involving the cervical spine, and congenital anomalies.

Patients in the study group received low-frequency, high-intensity magnetic therapy in addition to cervical stabilization exercises (CSE). Patients in the control group were treated with sham magnetic therapy along with the same CSE regimen as the study group. Deep cervical muscle activity was assessed using cervical stabilizer biofeedback, while cervical pain and function were evaluated using the Neck Disability Index (NDI). Treatment consisted of three sessions per week

for five weeks, with each session lasting between 60 and 70 minutes. All variables were assessed both pre- and post-treatment for both groups.

Outcomes measures:

Deep cervical flexor endurance was assessed using a Stabilizer pressure biofeedback (Chattanooga stabilizer, USA 00-9296 Pressure Biofeedback). Subjects were positioned in a hook-lying position on a therapy table with their neck aligned in a neutral position, ensuring that their head and neck were straight. The pressure sensor of the stabilizer was placed under the neck. Subjects were instructed to nod their head gently as if saying 'yes,' while avoiding compensatory neck movements that might engage the sternocleidomastoid muscle. The goal was to maintain the pressure sensor reading 2 mmHg above baseline. The test was conducted within a pressure range of 20 mmHg to 30 mmHg, requiring subjects to sustain each 2 mmHg increment for 10 seconds without resting. The number of times the subject was able to hold the pressure at each level was recorded. Changes in body position that affect pressure were detected by the sphygmomanometer, which measures cervical muscle strength [6].

Cervical pain and function were evaluated using the Neck Disability Index (NDI). The test was scored as a raw score or converted to a percentage [7]. Each section of the NDI was rated on a scale from 0 to 5, where 0 indicates 'No pain' and 5 indicate 'Worst imaginable pain.' The scores for each section were summed to produce a total score. The test can be interpreted either as a raw score, with a maximum of 50, or as a percentage. A score of 0 or 0% indicates no activity limitations, while a score of 50 or 100% signifies complete activity limitation. A higher score reflects greater disability as reported by the patient.

Intervention:

Treatment was administered three times per week over a period of five weeks, with each session lasting between 60 and 70 minutes, depending on the patient’s capabilities. Each session included 30 minutes of magnetic therapy and 30 to 40 minutes of cervical stabilization exercises (CSE).

In the study group (GI), patients underwent a cervical stabilization exercises protocol combined with low-frequency, high-intensity magnetic therapy, administered at a frequency of 50 Hz and an intensity of 60 mT for 30 minutes per session. The treatment was conducted three times a week for five weeks [8].

In the control group (GII), patients received sham magnetic therapy along with the same cervical stabilization exercises protocol. Treatment in this group was also administered three times a week for five weeks. Initially, all patients were given training in postural realignment. Following this, cervical stabilization exercises were implemented. During these exercises, patients were instructed to maintain proper postural alignment. The stabilization exercises program included exercises using an elastic rubber band, such as cervical flexion-dynamic isometric (seated), cervical extension-dynamic isometric (seated), chest flies, bench press, shoulder shrugs, biceps curls, and bent-over rows (upright position). Exercises began with a yellow elastic rubber band and 15 repetitions. Each week, the number of sets and repetitions was increased, and exercises were provided as a home-based program to be performed at the end of each week [9].

Statistical analysis

The statistical analysis was conducted by using statistical SPSS Package program version 25 for Windows (SPSS, Inc., Chicago, IL. Independent t-test was used to compare between study group and control group for patients age variable. Chi-square test was used to compare between study group and control group for patients gender variable. Multivariate analysis of variance (MANOVA) used to compare the tested major variables of interest deep cervical muscle endurance and neck disability index score (NDI) at different tested groups and measuring periods. Bonferroni correction test was used to compare between pairwise within and between groups of the tested variables which F-value was significant from MANOVA test. The alpha point of 0.05 was used as a level of statistical significance. All statistical analyses were significant at 0.05 level of probability ($P \leq 0.05$).

3. Results

There was a significant interaction effect of groups and time (F-value=35.334; P=0.0001). Moreover, there was a significant effect of tested groups (F-value=48.432; P=0.0001), Also, there was a significant effect time (F-value=1064.039; P=0.0001).There was no statistically significant difference between both groups regarding age, sex (P> 0.05) (table 1).

The statistical analysis of measured variables pre and post treatment within each group revealed significant increase in deep flexors endurance and NDI score in both groups (P< 0.05), the percent of changes in deep cervical flexors and NDI score were 27.79, 89.02 in (GI) compared to 27.25, 65.80 in (GII) respectively.

The between-groups analysis revealed no significant differences between groups before treatment (at the baseline assessment) in all measured variables (P> 0.05). Post treatment between-groups analysis was as following; no significant difference in deep cervical flexors while, significant increase of NDI score in favor to (GI) (P< 0.05) (Table 1).

Table (1): Comparison of clinical general characteristics of patients in both groups

	General characteristics of patients		
	Age (years)	**Gender**	
		Males	**Females**
Study group (n=39)	37.95 ±4.71	19 (48.70%)	**20 (51.30%)**
Control group (n=39)	37.46 ±4.41	18 (46.20%)	**21 (53.80%)**
Statistic test value	0.471	**0.051**	
P-value	**0.639**	**0.821**	

Quantitative data (age) are expressed as mean ±standard deviation and compared statistically by t-independent test; Qualitative data (gender) are expressed as frequency (percentage) and compared statistically by Chi-square test; P-value: probability Value: non-significant (P>0.05)

Table 2: Comparison of Deep flexors endurance and NDI variables within and between both groups:

Variable		Study group (GI) Mean ± SD	Control group (GII) Mean ± SD	P- value
Deep flexors endurance	Pre- treatment	22.67 ±0.95	22.97 ±1.01	0.173
	Post- treatment	28.97 ±1.01	29.23 ±0.98	0.255
	P- value	0.0001*	0.0001*	
NDI score	Pre- treatment	34.41 ±5.33	34.97 ±5.19	0.552
	Post- treatment	7.56 ±2.46	19.21 ±2.88	0.0001*
	P- value	0.0001*	0.0001*	

*Significant: P- value ≤0.05, NDI: Neck disability index

4. Discussion

Findings of the current study revealed a significant increase in deep cervical flexors muscle endurance in both groups post treatment. Also, this may be attributed to cervical stabilization exercises counteracting the increased activation of superficial flexors and significantly improving the endurance of deep flexor muscles [10]. This finding aligns with Kuo et al. [10], who concluded that cervical stabilization exercises are both feasible and beneficial for improving physical health in individuals with nonspecific neck pain. Additionally, the results are consistent with those of [11], [12], and Ghaderi et al. [13], who reported that cervical stabilization exercises enhance the endurance of deep cervical flexor muscles in patients with chronic neck pain. Jull. [14] Found that cervical stabilization exercises involving neck flexion increase the activation of cervical deep muscles while reducing the compensatory actions of larger superficial muscles. Jeon et al. [12] also, demonstrated that cervical stabilization exercises enhance the activation of deep neck muscles, improve neck strength and endurance, and contribute to overall neck stability.

There was a statistically significant improvement in the Neck Disability Index in both groups, with a greater improvement observed in the study group (GI) ($P<0.05$). This enhanced outcome in the study group may be attributed to the added effect of high-intensity, low-frequency magnetic therapy combined with cervical stabilization exercises on cervical pain and disability.

The analgesic effect of low-frequency, high-intensity electromagnetic fields may be explained by several mechanisms. Physiologically, pain relief following magnetic therapy may result from presynaptic inhibition or decreased excitability of pain fibers [15]. At the molecular level, the effects of magnetic fields might involve conformational changes in ion channels or neuronal membranes, affecting action potentials. Multiple mechanisms likely contribute simultaneously, including potential indirect effects such as reduced activity of channel phosphorylation enzymes. Additionally, magnetic therapy may influence the actions of hormones, antibodies, and neurotransmitters at surface receptor sites on various cell types [16].

Our findings are consistent with Hattapolu et al. [17], who concluded magnetic therapy can be safely integrated into routine treatment for cervical disc herniation, in conjunction with traditional physical therapy methods. This integration leads to improvements in cervical joint range of motion, pain, and functional status, owing to its anti-inflammatory, anti-edema, analgesic, antispasmodic, and blood-boosting properties. Similarly, Fortina et al. [8] demonstrated that treatment with

electromagnetic fields significantly reduces pain and disability after just four sessions of 30 minutes each.

5. Conclusion

Adding the low frequency high intensity magnetic therapy to cervical stabilization exercises has a substantial impact on improvement on pain and disability in cervical spondylosis.

6. References

1. Theodore N. Degenerative cervical spondylosis. New England Journal of Medicine. 2020; 383(2): 159- 68.
2. Hurwitz E, Randhawa K, Yu H, Côté P, Haldeman S. The Global Spine Care Initiative: a summary of the global burden of low back and neck pain studies. European Spine Journal. 2018; 27: 796- 801.
3. Bakhsheshian J, Mehta V, Liu J. Current diagnosis and management of cervical spondylotic myelopathy. Global spine journal. 2017; 7(6): 572- 86.
4. Quittan M, Schuhfried O, Wiesinger GF, Fialka-Moser V. Clinical effectiveness of magnetic field therapy – a review of the literature. Acta Med Austriaca. 2000; 27(3):61–68.
5. Jeon J, Ju S, Jeong H. The effect of cervical stabilizing exercises in the standing position and the supine position on deep neck muscle strength and endurance. Journal of Physical Therapy Science. 2012; 24(5):423-5.
6. Magee D, Manske R. Orthopedic Physical Assessment-E-Book. Elsevier Health Sciences; 2020 .
7. Riddle D, Stratford P. Use of generic versus region-specific functional status measures on patients with cervical spine disorders. Physical therapy. 1998; 78 (9): 951-63.
8. Fortina M, Vittoria A, Giannotti S, Biandolino P, Cevenini G, Carta S. Short time effects of a low-frequency, high intensity magnetic field in the treatment of chronic neck and low back pain. AIMS Public Health. 2022; 9 (2): 307-15.
9. Akkan H, Gelecek N. The effect of stabilization exercise training on pain and functional status in patients with cervical radiculopathy. Journal of back and musculoskeletal rehabilitation. 2018; 31(2):247-52.
10. Kuo Y, Lee T, Tsai Y. Evaluation of a cervical stabilization exercise program for pain, disability, and physical impairments in university violinists with nonspecific neck pain. International journal of environmental research and public health. 2020; 17(15): 5430.
11. Hagberg M, Harms-Ringdahl K, Nisell R, Hjelm E. Rehabilitation of neck-shoulder pain in women industrial workers: a randomized trial comparing isometric shoulder endurance training with isometric shoulder strength training. Archives of physical medicine and rehabilitation. 2000; 81 (8): 1051- 8.
12. Jeon J, Ju S, Jeong H. The effect of cervical stabilizing exercises in the standing position and the supine position on deep neck muscle strength and endurance. Journal of Physical Therapy Science. 2012; 24 (5): 423- 5.
13. Ghaderi F, Jafarabadi M, Javanshir K. The clinical and EMG assessment of the effects of stabilization exercise on nonspecific chronic neck pain: A randomized controlled trial. Journal of back and musculoskeletal rehabilitation. 2017; 30 (2): 211- 9.
14. Jull G. Deep cervical flexor muscle dysfunction in whiplash. Journal of Musculoskelatal Pain. 2000; 8 (1-2): 143-54.

15. Hinman M, Ford J, Heyl H. Effects of static magnets on chronic knee pain and physical function: a double-blind study. Alternative Therapies in Health & Medicine. 2002 Jul 1; 8 (4).
16. Segal N, Huston J, Fuchs H, Holcomb R, McLean M. Efficacy of a static magnetic device against knee pain associated with inflammatory arthritis. Journal of Clinical Rheumatology. 1999; 5: 299- 304.
17. Hattapolu E, Batmaz I, Dilek B, Karakoç M, Em S, Çevik R. Efficiency of pulsed electromagnetic fields on pain, disability, anxiety, depression, and quality of life in patients with cervical disc herniation: a randomized controlled study. Turk J Med Sci. 2019; 49(4):1095-1101.