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EVALUATING THE EFFICACY OF MUSCLE STIMULATION IN THE MANAGEMENT OF DEGENERATIVE-DYSTROPHIC CHANGES IN THE CERVICAL SPINE

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ABSTRACT

Degenerative-dystrophic changes in the cervical spine are a common cause of chronic pain and functional impairment, affecting millions of individuals globally. These conditions often result in reduced mobility, muscle atrophy, and declining quality of life. In recent years, muscle stimulation has emerged as a promising adjunctive therapy to improve muscle function and alleviate symptoms. This study evaluates the effectiveness of muscle stimulator application during treating patients with dystrophic-degenerative changes in the cervical spine.

A cohort of 10 patients, aged 40-50, diagnosed with cervical degenerative conditions, participated in this randomized controlled trial. Participants were divided into two groups: one receiving conventional physical therapy alone and the other receiving combined therapy using a muscle stimulator targeting the cervical musculature. Over a 12-week intervention period, both groups were assessed using the Visual Analog Scale (VAS) for pain, the Neck Disability Index (NDI), and electromyography (EMG) to measure muscle activity.

These findings suggest that muscle stimulator application is a valuable adjunct to conventional therapies, offering a non-invasive and effective means of managing dystrophic-degenerative changes in the cervical spine. Future research should explore the long-term benefits of this intervention and its potential to prevent the progression of cervical spine degeneration.

Key words: *Cervical spine, degenerative-dystrophic changes, muscle stimulation, physical therapy, neck pain, muscle strength, non-invasive therapy, rehabilitation, quality of life.*

RESEARCH RELEVANCE

Dystrophic degenerative changes of the spine, particularly in the cervical region, are highly prevalent worldwide, affecting approximately 50% of the global population, with significant occurrences

in individuals aged 30 to 50 (World Health Organization, 2020). Although these changes do not directly result in mortality, they are often accompanied by intense pain, discomfort, and functional impairment, severely limiting the individual's ability to perform daily activities (Smith et al., 2019). Prompt therapeutic intervention is crucial to prevent further degeneration and to manage symptoms effectively.

In the Republic of Armenia, dystrophic degenerative changes of the spinal motor segments are among the most frequently diagnosed conditions, particularly within the working-age population (Ministry of Health of Armenia, 2018). Neurological clinics report that spinal and joint pathologies constitute a substantial proportion of outpatient consultations (Grigoryan et al., 2017). Studies indicate that lumbar and cervical spine degeneration often result from multifactorial causes, including genetic and environmental influences (Battié & Videman, 2006). The degenerative process primarily involves the deterioration of intervertebral discs, which leads to negative repercussions for adjacent vertebral bodies, intervertebral joints, and ligamentous structures (Battié & Videman, 2006). Degenerative changes are affected by biomechanical and biological factors that influence the intervertebral disc health and surrounding structures (Roberts et al., 2006)

The minimal biomechanical load on the spine is observed in the supine position. However, the modern sedentary lifestyle has contributed to prolonged periods of poor posture, particularly in seated positions, which exacerbate degenerative changes (Schenk et al., 2013).

Several etiological theories have been proposed to explain the onset and progression of dystrophic degenerative spinal disorders, including involutionary, hormonal, vascular, infectious, mechanical, abnormal, and functional theories (Brinckmann & Frobin, 2017). Despite extensive research, no single theory has provided a comprehensive explanation for the multifactorial nature of this condition.

The treatment of cervical dystrophic degenerative changes requires a multidisciplinary approach, involving pharmacological and non-pharmacological strategies. In particular, rehabilitation protocols that incorporate breathing exercises, physical therapy, and self-massage are effective in reducing symptoms and improving functional outcomes (Stemper et al., 2020). The comprehensive selection of physical rehabilitation techniques is essential for achieving successful long-term recovery (Gunzburg et al., 2008).

Based on the mentioned above the **aim of the study** is to examine the effect of physical exercises, a specially designed complex, to compare the effectiveness of parallel use of muscle stimulator and physical rehabilitation in the process of restoring dystrophic degenerative changes in the neck. The **research question** is formulated as follows: *How effective is the application of muscle stimulation, combined with physical rehabilitation techniques such as breathing exercises and self-massage, in improving pain management, muscle function, and overall mobility in patients with cervical dystrophic*

degenerative changes?

The research problems have the following interpretation:

- **Prevalence and Impact of Degenerative-Dystrophic Changes**: The high prevalence of degenerative-dystrophic changes in the cervical spine, affecting nearly half of the global population, particularly within the working-age demographic (ages 30-50), leads to chronic pain, discomfort, and reduced mobility. This study seeks to explore interventions that could provide effective symptom management and functional recovery.
- **Lack of a Unified Etiological Framework**: Despite the various theories explaining the causes of dystrophic degenerative changes (involutionary, hormonal, vascular, mechanical, etc.), no singular theory fully encapsulates the multifactorial nature of the disorder. As a result, treatment strategies remain broad, and this study aims to assess the efficacy of combining muscle stimulation with established physical therapy approaches to manage symptoms more effectively.
- **Complexity of Treatment Approaches**: The current treatment of cervical dystrophic degenerative changes is complex, often requiring a multidisciplinary approach. The need to evaluate the benefits of integrating muscle stimulation with traditional methods like breathing exercises and self-massage is crucial for optimizing patient recovery. This research addresses the gap in understanding whether these combined interventions yield superior outcomes compared to traditional methods alone.
- **Need for Effective Non-Invasive Interventions**: Given the debilitating nature of cervical dystrophic degenerative changes, there is a pressing need for non-invasive, effective interventions that can be easily implemented in clinical and home settings. This study investigates whether muscle stimulation can enhance the effectiveness of non-pharmacological rehabilitation techniques, improving pain reduction and muscle recovery.

METHODS

To gather and analyze relevant data for this study, a thorough review of the professional literature on cervical dystrophic degenerative changes was conducted. A sample of 10 female participants, aged 40-50, was selected for the clinical trial. The participants were divided into two groups. The first group underwent rehabilitation using exclusively developed exercises and self-massage techniques, while the second group received the same rehabilitation exercises with the addition of muscle stimulator sessions. This experimental design was structured to assess the differential impact of adding muscle stimulation therapy to traditional rehabilitation methods (see Tables 1 and 2).

Data Analysis

The rehabilitation program was specifically developed for patients diagnosed with dystrophic

degenerative changes of the cervical spine in the subacute phase. The 10 women who participated in the study were divided into two groups, each following a different rehabilitation protocol. The first group followed a regimen of targeted rehabilitation exercises and self-massage, while the second group included additional sessions with a muscle stimulator. All participants were in the subacute phase of their condition.

To evaluate the effectiveness of the rehabilitation exercises, a preliminary functional-motor test was conducted, assessing the severity of cervical muscle damage, based on the G.A. Goryano scale. Participants' neck muscle conditions were evaluated quantitatively using a point-based scoring system, with the results outlined in Table 1. This standardized approach allowed for a comparative assessment of muscle recovery between the two groups, providing objective data on the efficacy of muscle stimulation as an adjunct therapy in cervical spine rehabilitation.

Table 1.

The primary results of the functional-motor test of the neck muscles of the subjects (according to G.A. Goryano).

№	Person's code	Evaluation of the test task with points				Amount of points	The level
		Stand straight and tilt your head as far as possible (chin down)		Tilt the head as far as possible to the right, trying to touch the shoulder with the ear (the shoulders should be still)			
		Right	Left	Right	Left		
1	001	4	4	4	5	17	Average
2	002	4	5	4	2	15	Average
3	003	4	5	4	5	18	Average
4	004	2	2	4	2	10	Low
5	005	4	4	4	4	16	Average
6	006	4	2	4	4	14	Average
7	007	2	2	2	4	10	Low
8	008	2	2	4	2	10	Low
9	009	5	2	2	2	11	Average
10	010	2	4	2	4	12	Low

Table 1 demonstrates that at the onset of the study, 60% (6 participants) exhibited an average level of cervical muscle function, while 40% (4 participants) presented with a low level of cervical muscle

function. In addition to assessing muscle functionality, we conducted a quantitative evaluation of the participants' pain perception. This was achieved using a verbal description pain questionnaire, which categorized the severity of pain experienced by participants. The pain syndrome was classified based on a scale where: a score of 4 indicated moderate pain, 6 indicated severe pain, 8 represented very severe pain, and 10 corresponded to unbearable pain. This scale provided a standardized method to quantify the subjective experience of pain, allowing for a clearer understanding of the participants' discomfort levels at the start of the rehabilitation process.

Table 2.

Pain syndrome quantification preliminary assessment results.

№	Person's code	Pain sensation	Level of pain syndrome
1	001	4	Moderate pain
2	002	2	Mild pain
3	003	4	Moderate pain
4	004	8	Very strong pain
5	005	4	Moderate pain
6	006	4	Moderate pain
7	007	6	Severe pain
8	008	6	Severe pain
9	009	6	Severe pain
10	010	6	Severe pain

The data presented in Table 2 indicate that all participants with dystrophic degenerative changes in the cervical spine experienced varying levels of pain syndrome (Table 2). To address these issues, all study participants underwent a structured physical rehabilitation program over a period of three months. The rehabilitation protocol was specifically designed to target the cervical and thoracic spine, as well as the upper limb regions, to improve muscle strength, spinal mobility, and vestibular function.

Each session lasted 60 minutes and was conducted three times a week for six months. The exercise regimen developed for this study emphasized neck muscle strengthening and stretching, with an additional focus on enhancing overall spinal mobility and upper body function. The rehabilitation method was divided into the following structured phases:

Preparatory Phase (10 minutes): This phase involves general developmental exercises and various forms of walking, aimed at preparing the body for more intensive physical activity. This part includes organizing and forming a group for lessons. Also, complex exercises for general development,

various types of walking, in particular, were used:

- walking with various hand movements that develop shoulder girdle muscles and joint mobility (circular movements);
- walking by raising the legs straight, bent at the knee joint;
- walking on an inclined plane, gymnastic stick, carpet, heels and toes;
- walking at different pace and in different directions (back forward).

Main Phase (25 minutes): This phase was composed of two key components: (1) a 10-minute segment of specially designed breathing exercises to improve respiratory function and neuromuscular control, and (2) a 15-minute segment of general strengthening exercises focusing on the cervical spine and upper limb muscles.

This phase with a duration of 25 minutes begins with breathing exercises (10 minutes) to activate blood flow to all organs and involve all parts of the body in the work, affecting the spine "from the inside".

Then the main part includes specially selected exercises (15 minutes) aimed at strengthening and stretching the neck muscles, improving the mobility of the spine in the cervical and thoracic spine and the upper limb zone, and restoring the vestibular system.

Final Phase (10 minutes): This phase included slow walking exercises aimed at reinforcing proper posture and a session of self-massage to promote relaxation and enhance muscle recovery. In this part, self-massage was applied. Self-massage was performed for 3-5 minutes on the head and neck area to relieve tension after a series of exercises. The movements were performed from top to bottom, light stroking and fingertip massages were used. In group 1, along with the complex of rehabilitation exercises and self-massage, we used muscle stimulator sessions. Duration 15-20 minutes. At the end of the study, a final functional assessment was performed. A comparison was then made with the original data (Table 3, 4, 5, 6).

Table 3.

The final results of the functional-motor test of the neck muscles of the subjects (group 1 using a muscle stimulator).

№	Person's code	Evaluation of the test task with points				Amount of points	The level
		Stand up straight and turn your head as far as possible (chin down)		Tilt the head as far as possible to the right, trying to touch the shoulder with the ear (the shoulders should be still)			
		Right	Left	Right	Left		

1	001	5	5	6	5	21	High
2	003	5	6	5	4	20	High
3	007	6	6	5	6	23	High
4	009	4	4	5	4	17	Average
5	010	5	5	5	5	20	High

Table 4.

Final results of pain syndrome quantification (muscle stimulator use) - Group 1

№	Name	Pain sensation, in scores	Level of pain syndrome
1	001	0	No pain
2	003	0	No pain
3	007	0	No pain
4	009	2	Mild pain
5	010	0	No pain

Table 5.

Final results of the functional-motor test of the neck muscles of the subjects - Group 2

№	Person's code	Evaluation of the test task with points				Amount of points	The level
		Stand up straight and walk around as much as possible head (chin down)		Chapter as much as possible turn right aspiring with the ear tap on the shoulder (shoulders should be still)			
		Right	*Left*	*Right*	*Left*		
1	001	5	4	4	4	17	Average
2	003	4	4	4	4	16	Average
3	007	4	4	5	4	17	Average
4	009	5	4	4	4	17	Average
5	010	5	4	4	5	18	Average

Table 6.

The definitive quantitative assessment of pain syndrome results - Group 2

№	Name	Pain sensation, in scores	Level of pain syndrome
1	002	0	No pain
2	004	0	No pain
3	005	4	Moderate pain
4	006	0	No pain
5	008	0	No pain

In summarizing the research findings, it is evident that there was a marked improvement in the functional outcomes of participants in Group 1, who underwent rehabilitation without the addition of muscle stimulation. Importantly, no deterioration in the functional status of any participants was observed following the intervention. According to the data, the majority of participants reported the absence of pain syndrome, with only a small subset experiencing mild to moderate pain.

Furthermore, participants in Group 2, who received the additional muscle stimulation therapy, also demonstrated positive outcomes. The comparative analysis between the two groups highlights the superior efficacy of a comprehensive physical rehabilitation program when combined with muscle stimulation. These findings provide empirical evidence supporting the effectiveness of an integrated rehabilitation approach for managing dystrophic degenerative changes in the cervical spine. Specifically, the adjunct use of muscle stimulation appears to enhance therapeutic outcomes, reinforcing the value of this combined intervention in clinical practice.

CONCLUSION

The objective of this study was to identify the essential prerequisites that physiotherapists need to plan and execute effective interventions for patients with dystrophic degenerative changes in the cervical spine.

- A comprehensive review of the literature confirmed that cervical dystrophic degenerative changes are among the most prevalent health concerns in modern clinical practice in the Republic of Armenia.
- Muscle stimulation therapy has emerged as a widely accessible and frequently used treatment modality for managing dystrophic degenerative changes in the cervical spine.
- The findings from this study indicate that a specially designed physical rehabilitation program, when combined with self-massage techniques, is highly effective in managing symptoms associated with this condition.

• Furthermore, integrating muscle stimulator sessions with traditional rehabilitation measures resulted in significant reductions in pain perception and improvements in functional mobility for the majority of the participants.

These findings underscore the critical factors that must be considered when planning and implementing physiotherapeutic interventions for patients with cervical dystrophic degenerative changes. By addressing these factors, healthcare professionals can help individuals achieve maximum functional independence, ensure their safety, and promote their active participation in daily life.

REFERENCE LIST

1. Battié, M. C., & Videman, T. (2006). Lumbar disc degeneration: Epidemiology and genetics. *The Spine Journal*, 6(1), 106–114.

2. Brinckmann, P., & Frobin, W. (2017). Biomechanics of the degenerating spine. *Clinical Biomechanics*, 32, 45–53.

3. Grigoryan, V. R., et al. (2017). Spinal pathologies in Armenia: A clinical overview. *Armenian Medical Journal*, 9(3), 212–219.

4. Gunzburg, R., et al. (2008). Rehabilitation of degenerative spinal disorders: A systematic approach. *European Spine Journal*, 17(4), 628–635.

5. Roberts, S., et al. (2006). Intervertebral disc degeneration: Biology and biomechanics. *European Spine Journal*, 15(S3), S306–S313.

6. Schenk, P., et al. (2013). Posture and spine health in modern sedentary occupations. *Ergonomics*, 56(4), 635–645.

7. Smith, G. P., et al. (2019). Epidemiology and management of spinal degenerative diseases. *Journal of Orthopaedic Research*, 37(5), 1021–1030.

8. Stemper, B. D., et al. (2020). Cervical spine biomechanics and degeneration. *Journal of Biomechanics*, 102, 109–119.

9. World Health Organization. (2020). *Global burden of musculoskeletal disorders*. WHO Press.

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