

ORIGINAL SCIENTIFIC PAPER

Comparative Efficacy of Isometric versus Dynamic Exercises on Cervical Spondylosis

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Abstract

Cervical spondylosis is a degenerative disorder in the neck that is very common and worsens with age: it can limit the ability to participate in normal activities and is also costly to treat. The purpose of this study was to observe the effect of isometric and dynamic exercises on cervical spondylosis. This study was conducted at the center for physical therapy and rehabilitation in "Banja e Kllokotit", Kllokot, Kosovo. The total number of patients included in the study was 60 people of both sexes, who were randomly divided into two groups (group A, n=30; group B, n=30) and received ten sessions of physical therapy. Group A was treated with thermotherapy, electrotherapy, dynamic exercises for the muscles of the cervical region, stretching and deep transverse massage; while group B was treated with thermotherapy, electrotherapy, isometric exercises, and stretching. Range of motion was measured with a standard goniometer, while the level of pain was estimated by the numerical rating scale of pain (NRS). Evaluation of patients was done before and after ten sessions of treatment. The results showed significant difference between groups related to mobility in flexion ($P=0.052$), extension ($P=0.743$) side bending ($P<0.000$) and pain parameters ($P<0.000$); the group of patients treated with dynamic exercise showed better results and performance after 10 sessions of physical therapy. It can be concluded that dynamic exercise produces better results compared to isometric exercises.

Keywords: cervical spondylosis, neck pain, isometric exercise, dynamic exercise

Introduction

Neck is one of the most complex parts of the human body. This complexity is attributed to its anatomic and physiologic construction. Neck pain is a common medical condition that can limit the ability to participate in normal activities and is also costly to treat (Kay et al., 2012). Neck pain can be caused by several disorders and diseases; it may involve any of the tissues in the neck and the most common cause of neck pain is a degenerative disorder (Hirpara, Butler, Dolan, O'Byrne, & Poynton, 2012). Neck pain is also referred to as cervical pain, which is commonly associated with dull aching: sometimes, neck pain may become worse with movement of the neck or turning of the head.

There are many treatments available for neck pain, but not all of them have the same effects on the neck, which is the reason for many scientific contradictions regarding treatment techniques. The most frequent techniques used are the McKenzie method,

manual mobilization, gliding techniques and exercise (Falla et al., 2007; Salt, Kelly, & Soundy, 2016). In a previous study (Kendall et al., 2018), it has been stated that dizziness may be dangerous for older people because dizziness, which is a symptom of neck pain, may cause them to fall. 'Spinal manipulative therapy (SMT)' is another method that is widely used to treat neck pain: this method is beneficial because it has been shown to lower neck pain especially in older people, without causing any side effects. It is well known that people have different pain perception threshold. Because cervical pain is almost always chronic and continuous, we should consider the influence of exercise on stress hormones. A recent study has shown that regular aerobic physical activity has a positive effect on stress hormones, thus decreasing the chronic pain threshold (Gashi et al., 2020; Gashi et al., 2021).

Based on the literature, there is a lack of studies applying standard treatment approaches for patients with neck pain; ma-



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ny conservative treatments are prescribed by combining different treatment techniques and modalities; most of the studies describe the advantages of strengthening exercises (Khan, Soomro, & Ali, 2014; Sowmya, 2014; Abelkader, 2021). However, there is not enough evidence for the effectiveness of dynamic exercises, and the need to have more evidence for dynamic exercise effectiveness is the reason and the aim of this study. The purpose of this study is to compare the efficacy of two main types of exercises (i.e., isometric and dynamic strengthening exercise) and to determine whether dynamic exercise is more effective at reducing pain and improving mobility in patients with cervical spondylosis.

Materials and methods

Participants

This is a prospective short term study which was conducted at the center for physical therapy and rehabilitation “Banja e Kllokotit”, Kllokot, Kosovo. The total number of patients included in the study was 60 people of both sexes, and they received ten sessions of physical therapy. The patients were randomly divided into two groups (group A, n=30, and group B, n=30). To perform the study according to the ethical medical standards, the permission from the ethical committee of the rehabilitation center was received (nr. 01/13).

Experimental treatment

Group A was treated with thermotherapy for 15-20 min in the cervical region, electrotherapy transcutaneous electrical nerve stimulation (TENS) for 20 min, dynamic strengthening exercise against gravity for the muscles of the cervical region, stretching, and deep transverse massage. Dynamic strengthening exercise involves movement that produces changes in muscle length. These types of exercises involve two types of contractions (i.e., concentric and eccentric contractions), which produce changes in muscle length and joint angles. During concentric contractions, the muscles contract as they shorten; while during eccentric contractions, the muscles lengthen; during both forms of exercise, the muscles produce force and strengthen; in addition, the movement of the joint increases, other surrounding structures (e.g., ligaments, capsule, and muscles) will gain more flexibility, which means that dynamic strengthening will occur in

all ranges of movement in the joint (Sowmya, 2014).

Group B was treated with thermotherapy (15-20 min), electrotherapy (TENS for 2 min), isometric strengthening exercise which is a static form of contraction of the muscles; the contraction must be held against resistance for a minimum 6 s to increase the tension in the muscle and to allow metabolic changes to occur (Sowmya, 2014), and passive stretching of the cervical muscles, which was applied to each muscle group for 10-15 s.

Measurements

The range of motion for flexion, extension and side bending of the neck was measured with a standard goniometer (6” Baseline 360 Degree Goniometer, 12-1002HR, Fabrication Enterprises, QM338800), (Whitcroft et al. 2010; Farooq et al. 2016), while pain was estimated by the numerical rating scale of pain (Hjermstad et al. 2011; Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011; Alghadir et al 2018). The evaluation of patients was done before and after ten treatment sessions. The inclusion criteria were patients with sub-acute and chronic cervical spondylosis. While the exclusion criteria were acute stage of disease, and patients with other cervical spine problems (e.g., intervertebral disk hernia on the cervical spine and, spinal stenosis).

Statistical analysis

Presentation of data was done through tables and graphs. Data processing was done with the InStat statistical package (Beath & Davies, 1994). From the statistical parameters, the arithmetic averages, standard deviation, as well as minimum and maximum value were calculated. For non-parametric data testing, the Mann-Whitney test was used. Verification of the tests for the degree of reliability was $P > 0.05$.

Results

A total of 60 participants were recruited into this study from the center for physical therapy and rehabilitation. The two groups were compared regarding mobility in flexion after ten sessions of physical therapy. Using the Mann - Whitney test, we did not obtain a statistically significant difference between groups in flexion ($U' = 581$, $P = 0.052$, $P > 0.05$), (Table 1) and in extension ($U' = 472.5$, $P = 0.743$, $P > 0.05$), (Table 2).

Table 1. Flexion difference parameters by groups

Flexion	Group A	Group B
N	30	30
Mean	2.5	1.1
DS	2.0	0.9
Min	0	0
Max	7	3
Mann-Whitney test	$U' = 581$, $P = 0.052$	

Table 2. Extension difference parameters by groups

Extension	Group A	Group B
N	30	30
Mean	4.0	2.1
DS	1.2	0.8
Min	2	0
Max	6	4
Mann-Whitney test	$U' = 472.5$, $P = 0.743$	

The mean difference in the left lateral neck flexion after ten sessions in both groups was 3.70 (DS \pm 2.10), range 0-100. Using the Mann-Whitney test we obtained a statistically significant difference between groups (U '=842.5, P <0.000),

(Table 3). In the right neck side bending the mean difference after ten sessions in both groups was 3.70 (DS \pm 2.70), range 0-100. Using the Mann-Whitney test, we obtained a statistically significant difference (U '=845.5, P <0.000), (Table 4).

Table 3. Difference parameters in lateral neck flexion on the left side

lateral neck flexion on the left side	Group A	Group B
N	30	30
Mean	5.1	2.3
DS	2.0	0.8
Min	0	0
Max	10	4
Mann-Whitney test	U '=842.5, P <0.000	

Table 4. Difference parameters in lateral neck flexion on the right side

lateral neck flexion on the right side	Group A	Group B
N	30	30
Mean	5.6	1.8
DS	2.4	1.2
Min	0	0
Max	10	4
Mann-Whitney test	U '=845.5, P <0.000	

Comparing the values of pain in both groups, the obtained results showed that the mean difference in pain after ten sessions in both groups was 4.00 (DS \pm 1.00), the mean difference in pain after ten sessions in group A was 4.80 (DS \pm 0.60) while

in group it was 3.20 (DS \pm 0.40) although the mean difference in pain after ten sessions in both groups was 4.00 (DS \pm 1.00). Using the Mann-Whitney test, we obtained statistically significant difference between groups (U '=877.5, P <0.000), (Table 5).

Table 5. Parameters of difference in pain by groups

Pain	Group A	Group B
N	30	30
Mean	4.8	3.2
DS	0.6	0.4
Min	4	3
Max	6	4
Mann-Whitney test	U '=877.5, P <0.000	

Discussion

Physiotherapy has been shown to be very effective in the treatment of cervical spondylosis (Lauchet et al., 2016; Azemi et al., 2018); based on the evidence, different treatment methods have shown high effect on pain and mobility in cervical spine (Leaver, Refshauge, Maher, & McAuley, 2010; Hirpara, Butler, Dolan, O'Byrne, & Poynton, 2012). In this study we compared the effect of isometric and dynamic exercises in patients with spondylosis. The obtained results showed that the level of pain was significantly decreased in both groups, and cervical mobility was improved.

Both exercise protocols (i.e., dynamic and isometric exercise) were very effective. Dynamic exercises and deep transverse massages were more effective in treating cervical spondylosis. Similar results have been reported by other authors who concluded that dynamic exercises were more effective in treating cervical spondylosis (Cramer et al., 2012; Lauche et

al., 2016; Wong, Shearer, Mior, Jacobs, & Cote, 2016; Gashi et al., 2019). Of note, the combination of both techniques may be more effective in treating cervical spondylosis. However, in our study, mobility during flexion and extension was not significantly increased, and there was no significant difference between groups. One factor that may have influenced these results is the combination of treatment techniques which may have approximately the same effect on flexion and extension mobility: another factor might be the short duration of treatment. While lateral flexion in both sides was significantly increased, these data are comparable to those of other authors (Boyles, Toy, Mellon, Hayes, & Hammer, 2011; Gemma V., & Antonia, 2014).

Based on the evidence, different forms of manual treatment have shown to be very effective treating cervical spondylosis. In this study, the use of deep transverse massage in combination with dynamic exercise may have had higher effect on

reducing neck pain: this technique has been shown to be very effective: the same data have been also reported by authors (Bernal-Utrera et al., 2020).

However, other authors have reported that supervised exercises are more effective than unsupervised neck exercises in the treatment of patients with cervical spondylosis: in addition other authors have reported that supervised, controlled home exercise have a positive effect on reducing pain (Kuukkanen, Tiina, et al., 2007; Ibrahim et al., 2018). A recent study has reported that after an 8-week intensive home-exercise therapy program, there is a significant increase in cervical range of motion in flexion, extension, lateral flexion and rotation (Freimann, Merisalu, & Pääsuke, 2015).

Another recent study has shown that motor control with segmental exercises is effective at reducing short-term pain and disability, but long-term outcomes have not been inves-

tigated (Gashi & Azemi, 2019; Price, Rushton, Tyros, Tyros, Heneghan, 2020). These data are in line with our results: however, our study did not evaluate long-term treatment. Therefore, the main limitation of this study is that it does not have a large sample size: thus a larger sample size may refute our findings.

Conclusion

The results suggest that the use of both dynamic and isometric exercise treatment may improve cervical range of motion among patients with cervical spondylosis. Regarding statistical significance, it can be concluded that dynamic exercises produce slightly better results compared to isometric exercises. Further studies are needed to develop this simple but effective home-exercise therapy protocol to help motivate patients with cervical spondylosis to perform such exercises regularly.

Acknowledgements

There are no acknowledgements.

Conflict of Interest

The authors declare that there are no conflicts of interest.

Received: 01 July 2021 | **Accepted:** 06 May 2022 | **Published:** 01 June 2022

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