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Case Report

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The Effectiveness of Remote Exercise Training to an Individual with Chronic Neck Pain: A Case Report

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Abstract

Neck pain is a very common problem that creates a socio-economic burden. One of the most common causes of neck pain is disc herniation and often causes the pain to become chronic. Factors such as poor posture, long working hours, and psychological stress exacerbate the symptoms related to the cervical region. Surgical nurses are also at high risk for neck pain. Also, due to the Covid-19 pandemic, many patients, especially healthcare professionals, cannot access physiotherapy and rehabilitation services both due to their busy work and to reduce the risk of contamination. Therefore, this study aimed to examine the effectiveness of remote spinal stabilization exercises in a patient with chronic neck pain. Pain, disability, kinesophobia, grip strength, and quality of life of a 26-year-old female patient who was an operating room nurse were evaluated. Architectural features of the muscles were evaluated by ultrasonography. 3 days a week, 5 weeks of distance exercise training was given. As a result, it was observed that pain, kinesiophobia, and disability levels decreased, quality of life and grip strength increased in this case. M. Longus Colli thickness was found to be increased. Also, the patient stated that her symptoms were reduced and she was less tired at work. This study is the first to provide remote exercise training for a surgical nurse with chronic neck pain. It is thought that the results of this study will shed light on more comprehensive studies on surgical nurses.

Keywords: Neck pain, Telerehabilitation, Ultrasonography, Physiotherapy.

INTRODUCTION

Neck pain is the most common musculoskeletal problem that causes healthcare admission after low back pain [1]. It is stated that approximately 70% of individuals experience neck pain at least once in their lifetime [2]. Problems in the cervical region negatively affect daily life and work life, and this creates a great socioeconomic burden. According to a study conducted in this field, neck pain has been accepted as one of the primary problems causing disabilities worldwide since 2014, and the need for detailed research in this area has increased [3].

The cervical region is the most different and complex part of the spine in anatomical and functional aspects. Although there are many deep and superficial muscles attached to this complex region, the dysfunction that may occur in any of the muscles can spread to the entire spine or even the upper extremity by creating a domino effect. It has been shown that cervical muscles, especially deep cervical flexor and extensor muscles, are associated with cervical pathologies [4, 5]. To maintain the functionality of the cervical region, the activation of deep and superficial muscles must be in balance. The main problem related to this balance is that the activation of the superficial muscles increases due to insufficient deep muscle activation [6]. There are also studies showing that there is a transition from Type 1 to Type 2 in deep muscle fiber content in individuals with neck pain [7, 8]. It is also stated that the relationship between neck pain and architectural features of deep and superficial cervical muscles should be investigated [9]. Knowing the architectural features of the muscles and examining the change in neck pain will be guiding for the treatment program.

Neck pain is most common in people who desk-based office workers, have an inappropriate posture, and health professionals [2]. The common point of these populations, which are a risk group for the cervical region problem, is that the cervical region muscles are loaded in an inappropriate position for a long time. It is stated that the riskiest group among healthcare professionals is dentists and nurses [10]. It is known that the annual prevalence of neck pain observed in nurses varies between 23.6% and 62.7%, and the loss of the nursing workforce due to neck pain varies between 3.9% and 5.1% each year [11, 12]. Studies have

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indicated that surgical nurses establish the balance between private life and work-life more difficult than other health professionals. Factors such as unplanned and sudden surgeries, weekend or shift work make this balance even more difficult [13-15]. In a study conducted in 2016, it was emphasized that surgical nurses stay in standing and fixed position for hours during long surgeries, in addition to the high levels of psychological stress during the surgical procedure [16]. As a result, surgical nurses are among the healthcare professionals who are exposed to the most physical and psychological stress.

Due to factors such as the Covid-19 pandemic, technological developments, and the increased importance given to cost-effectiveness, telerehabilitation studies have gained momentum. Access to physiotherapy and rehabilitation services has become quite difficult due to precautions such as equipment, physical space, and distance between individuals to minimize the risk of transmission due to pandemic conditions [17]. Therefore, it is thought that telerehabilitation will gain much importance for physiotherapy applications in the future. When the research was conducted on telerehabilitation studies involving spinal stabilization exercises, which is an effective and safe concept for spinal health, a very limited number of studies were found for low back pain, but no studies were found for neck pain [9]. Therefore, in this case study, we aim to examine the effectiveness of spinal stabilization exercise training to be applied remotely to a surgical nurse with chronic neck pain on muscle architecture and clinical variables.

CASE REPORT

A 26-year-old right dominant female patient applied to the neurosurgery outpatient clinic 3 years ago with sudden onset neck pain but did not receive any treatment. In this center, as a result of Magnetic Resonance Imaging (MRI), it was reported that there were disc herniations at the protrusion level at the C2-3, C3-4, and C4-5 levels and the cervical lordosis was flattened. The patient, who was working as a surgical nurse in a private hospital, had a height of 168 cm, a bodyweight of 63 kg, and a body mass index of 22.3. She stated that she stayed up for very long hours due to her job and generally looked at a distance below eye level during the surgery. The patient was not using any medication. She did not have any pathology related to her medical history. However, regarding her family history, she stated that her father had chronic rheumatoid arthritis.

The patient's main complaint was neck pain radiating to both arms. The patient, who sometimes felt numbness in her fingers, stated that all these symptoms increased with fatigue. She also stated that the patient's complaints were more pronounced on the right. Besides, the patient stated that these complaints negatively affected her job status and decreased her professional performance.

Evaluation

During palpation, tenderness and pain in the upper Trapezius and Sternocleidomastoideus muscles were recorded.

Range of Motion Assessment: Cervical flexion, extension, lateral flexion, and rotation range of motion of the patient were evaluated with a goniometer [1].

Muscle Strength Assessment: Manual muscle test was used for motor evaluation. Shoulder elevation (C4), arm abduction (C5), elbow flexion (C6), elbow extension (C7), interosseal adduction (C8), and thumb abduction (T1) were evaluated for both sides [18].

Pain Assessment: The patient's pain was assessed with the Visual Analogue Scale (VAS) by questioning rest, activity, and night pain [19].

Sensory Assessment: Sensory assessment was performed with Semmes Weinstein monofilaments [20]. Supra hyoid area (C3), Trapezius upper part (C4), Deltoid (C5), thumb-index finger (C6), 2nd metacarpal dorsum (C7), 5th metacarpal dorsum (C8), and proximal of ulnar styloid (T1)) levels were evaluated bilaterally.

Grip Strength Assessment: Grip strength was evaluated bilaterally using a Jamar hand dynamometer [21].

Tests Specific to the Cervical Region: Cervical distraction, Spurling, vertebrobasilar artery test, Adson and Roos tests were performed bilaterally for disc herniation in the cervical region [22].

Posture Assessment: The patient's posture was analyzed from anterior, posterior, and lateral by observational assessment method [18].

Craniocervical Flexion Test: The strength of deep cervical flexors was evaluated with a pressurized biofeedback device (Stabilizer ™, Chattanooga Group Inc. USA) [23].

Disability severity of the patient was evaluated with Neck Disability Index (NDI) [22] and Neck Bournemouth Questionnaire (NBQ) [24], kinesophobia severity with Tampa Kinesophobia Scale (TKS) (25), and quality of life with Short Form-36 (SF-36) [26].

Assessment of Architectural Features of Cervical Muscles: Muscle thickness of the Sternocleidomastoideus, Longus Colli, Upper Trapezium, and Levator Scapula muscles, and pennation angles of the Sternocleidomastoideus and Upper Trapezius muscles were evaluated with a Mobile Ultrasound device (3.5-10 MHz convex and linear probes (Soundcam Mobile Ultrasound Device)) [27,28].

Treatment

The patient was followed up with telerehabilitation due to the Covid-19 pandemic process. The first session was done face to face and cervical stabilization exercises were taught to the patient. Then, the exercises were progressed through live video calls with the patient 3 times a week. The exercise program applied to the patient is given below (Figure 1).

- Warm-up exercise (Stretching exercises for the Upper Trapez and Levator Scapula muscles)
- As the first step, craniocervical flexion was taught in supine, side-lying, crawling, and prone lying positions.
- Upper and lower extremity movements were added as a second step. These movements were changed first ipsilaterally and then contralaterally.
- In the third stage, resistance exercises were started on the upper extremity with the help of an exercise band.

When the patient was able to do all exercises painlessly for 30 repetitions, the next step was started. The exercise program was applied for 5 weeks, 3 days a week. Also, the patient was asked to do the exercises for 10 repetitions in 4 days when there was no live meeting

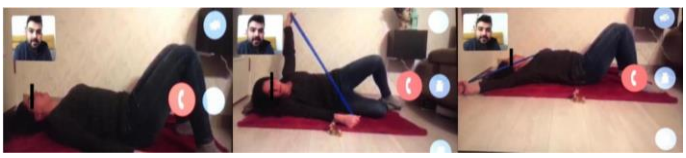

Figure 1: Examples of cervical stabilization exercises through live video calls

RESULTS

There was no loss of range of motion, muscle strength, and light touch in the evaluations made before and after the treatment. The pain severity, which was 60 mm before the treatment compared to VAS, was recorded as 35 mm after the treatment. The patient's handgrip

strength was 29 kg and 25 kg for the right and left sides, respectively, before treatment. After treatment, these values were recorded as 32 kg and 28 kg for the right and left sides. Although cervical compression and Adson tests were bilaterally positive before treatment, only the cervical compression test was positive for the right side after treatment. As a result of the observational posture analysis performed before the treatment, it was seen that the shoulders were in protraction and the head was in an anterior tilt. After the treatment, it was observed that despite the decrease in these postural disorders, shoulder protraction and anterior tilt of the head continued. The Craniocervical flexion test result of the patient increased from 2 mmHg to 6 mmHg. Changes in muscle thickness and pennation angles are shown in Table 1.

Before and after treatment, NDI scores were recorded as 18 and 11, NBQ scores as 19 and 13, TKS scores as 34 and 27, respectively. Quality of life assessment results was as follows with the SF-36 subdivisions before treatment; The total score was 285.8; energy 50, pain 55 emotional reactions 33.3, social function 62.5, sleep 25, physical activity 85. Post-treatment SF-36 scores were recorded as energy 40, pain 77.5, emotional reactions 85, social isolation 75, sleep 25, physical activity 90, the total score of 392.5.

Table 1: Changes in muscle thickness and pennation angles before and after treatment

Muscles	**Muscle Thickness (mm)**				**Pennation Angle (°)**			
	Right		**Left**		**Right**		**Left**	
	Before Treatment	**After Treatment**	**Before Treatment**	**After Treatment**	**Before Treatment**	**After Treatment**	**Before Treatment**	**After Treatment**
Sternocleidomastoideus	7,52	7,03	5,64	6.03	5,3	5,9	7,4	6,8
Longus Colli	4,59	7,51	4,35	6,24				
Üst Trapez	13,59	12.90	5,78	6.36	7,2	8,2	8,3	7,5
Levator Skapula	4,46	5,05	4,14	4,33				

DİSCUSSİON

In our case, as a result of the remote education program that lasted for 5 weeks, pain, disability, and kinesophobia levels decreased, while the level of grip strength and quality of life increased. Our patient stated that her symptoms decreased especially after the third week of the training program and that the pain that occurred during the operations started later. Besides, changes in cervical deep and superficial muscle thickness and pennation angles were also observed in our case.

In our case, the pain change according to VAS was determined as 25 mm, and the change according to NDI was 7 points. In the literature, the minimal clinical significance value of VAS for neck pain has been determined as 8 mm, and NDI as 10 points [29]. Based on this information, it is possible to say that while the decrease in pain intensity of our case is clinically significant, this situation is not reflected in the level of disability sufficiently. We think that this is due to the short duration of the training program. However, we can state that the 5-point increase in the physical activity sub-parameter of quality of life in our case is clinically significant. The minimal clinical significance value of the physical activity sub-parameter of the SF-36 questionnaire in neck pain was determined as 4.1 points [30]. As a result, the severity of pain and quality of life of our case improved clinically significantly as a result of the training program.

The Spurling test evaluates the radicular symptoms and is a 40-60% sensitive, moderate-to-good reliable test [31]. The Adson test is used to evaluate the narrowing of the thoracic outlet and is a frequently used test to distinguish patients with cervical disc herniation from patients with thoracic outlet syndrome [32]. The reason for our patient's negative Adson test after treatment may be the relaxation and flexibility in soft tissues that may affect the thoracic outlet. Besides, the Spurling test still positive after treatment indicates that the radicular symptoms continue. It is thought that this situation may be due to the short duration of treatment and various errors that may be made by the patient due to the remote exercise program.

Some studies on the cervical muscles indicate that muscle size indirectly reflects muscle strength [33, 34]. Ultrasonography is a non-invasive, non-ionizing, reliable, economical, and easily accessible method compared to other methods in terms of evaluating some architectural features of muscles, including muscle thickness and pennation angle [35]. In recent years, there has been an increase in studies evaluating various muscles with ultrasonography in individuals with neck pain [36]. Lack of activation in deep muscles has been shown to result in atrophy in individuals with neck pain [37]. The stabilizing ability of the atrophic deep muscles decreases, and therefore the superficial muscles have to be loaded for a long time, which is not suitable for their structure. This situation makes deep muscles more inactive and atrophic, and spasms are observed in superficial muscles due to excessive activation [37]. When our case results are examined, it is seen that the thickness of the Longus Colli muscle, which is evaluated as a deep muscle, increased after treatment. This may be due to the increase in the activation of the Longus Colli muscle during stabilization exercises. In the literature, the increase in muscle thickness as a result of protein synthesis and satellite cell proliferation due to strengthening exercises is first seen after the 3rd week [38]. Spinal stabilization exercises are not a strengthening exercise and therefore the maximal loading principle is not applied. For this reason, we think that muscle thickness increases due to the increase in motor activation of deep muscles thanks to the muscle training provided. Besides, the increase of 4 mmHg in the craniocervical flexion test also supports our thought. It is seen that thickness changes in superficial muscles are less. Also, no significant changes were observed in pennation angles. It can be thought that the activation of the superficial muscles could not be reduced sufficiently because our patient, who worked as a surgical nurse, continued to be loaded for a long time in the inappropriate posture.

Limitations

This case study has some limitations. Due to the short duration of the exercise program, the effectiveness of remote exercise may not be demonstrated sufficiently. Also, interventions that include ergonomic adjustments can be more effective.

CONCLUSİON

In conclusion, remote spinal stabilization exercise training had positive effects on pain, quality of life, grip strength, and deep cervical muscle thickness in a female patient with chronic neck pain who was diagnosed with cervical disc hernia and who was working as a surgical

nurse. There is a need for more comprehensive studies with this population in which neck pain is common, with the long-term follow-up that can be compared with face-to-face exercise training.

Conflict of Interest: We have no conflict of interest to declare.

Author's Contribution:

Exercise follow-up, ultrasonography evaluation, interpretation of results, article writing: Abdurahim Aslıyüce

Planning the study, interpretation and article writing: Özlem Ülger

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