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Case Report

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Efficacy of Suboccipital Release and Stabilization Exercise Training in Type 1 Chiari Malformation Patient Undergoing Surgical Treatment: A Case Report

Yasemin Özel Aslıyüce[1], Özlem Ülger[2]

1 *PT, MSc, Hacettepe University, Faculty of Physical Therapy and Rehabilitation, 06100, Sıhhiye, Ankara/Turkey*

2 *PT, Prof. Hacettepe University, Faculty of Physical Therapy and Rehabilitation, 06100, Sıhhiye, Ankara/Turkey*

Abstract

In Chiari malformation, some symptoms are known to recur after decompression surgery. To our knowledge, this is the first case for symptomatic outcome after suboccipital release and stabilization exercises the patient with type 1 Chiari malformation who has experienced surgery. The present study aims to investigate the efficacy of suboccipital release and stabilization exercise training in a patient with Type 1 Chiari Malformation undergoing surgical treatment. A 47-year-old female patient with Chiari malformation received suboccipital release and stabilization exercise training for 10 weeks. Her symptomatic parameters were evaluated, such as pain, grip and pinch strength, deep cervical flexor strength, balance and gait. After the treatment, there were improvements in pain perception, the score of performance index of deep cervical muscles, grip force, static balance and gait parameters. Suboccipital oscillation and stabilization exercises are thought to be safe and effective in patients with Chiari malformation undergoing decompression surgery.

Keywords: Arnold-Chiari malformation, Exercise training, Manual therapy, Physiotherapy.

***Corresponding author:**
Yasemin Özel Aslıyüce
PT, MSc, Hacettepe University, Faculty of Physical Therapy and Rehabilitation, 06100, Sıhhiye, Ankara/Turkey
Email:
fzt.yasemin.ozel@gmail.com
Tel: +905061437209

INTRODUCTION

Type 1 Chiari malformation is the displacement of the cerebellar tonsil at least 5 mm from the foramen magnum to the spinal canal. In patients with Type 1 Chiari malformation, 50% Syringomyelia can be seen [1]. Headache, neck pain, nausea, and some neurological findings are the most common symptoms. In addition, obstructive hydrocephalus and neurological symptoms may also be seen [2].

The purpose of surgical treatment is to provide decompression in the craniovertebral region. The most commonly used methods are the decompression of the posterior part of the foramen magnum, C1 laminectomy, duraplasty and tonsillar resection with suboccipital craniectomy [3, 4]. Success of surgery is higher in patients with mild symptom severity after surgery. However, success of surgery is lower in cases of chronic, over 40 years old, severe neurological deficits. In addition, although the rate of development of headache and ataxia symptoms is higher, the development of nausea and nonspecific symptoms is less [5]. To our knowledge, to date, there is not any research that examined the efficacy of physiotherapy in Chiari malformation after surgery. This study aimed to investigate the effectiveness of suboccipital release and craniocervical flexion exercises in a patient with Type 1 Chiari malformation who underwent craniocervical decompression surgery.

CASE REPORT

This case study is about a 47-year-old female who was diagnosed with Type 1 Chiari malformation in 2012. According to the preoperative MRI report, cerebellar tonsils were ectopically located about 7 mm and showed signs of syringohydromyelia involving the entire spinal cord up to the level of T2 vertebrae (Figure 1). Suboccipital craniectomy-duraplasty surgery was performed in 2013 due to increased symptoms.

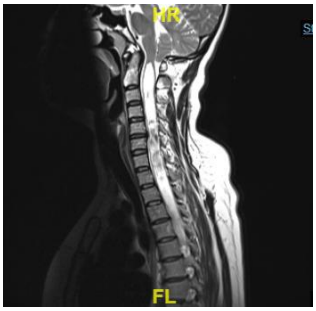

Figure 1: Preoperative magnetic resonance imaging of cervical spine sagittal section showing Chiari malformation with syringomyelia

The patient stated that after surgery, headache and neck pain, numbness in the right arm, dizziness recurred. Medical treatment was started for the patient since she applied to the department of neurology with the symptoms of headache and dizziness one year after the surgery. Six years after the surgery, MRIrevealed disc pathologies, decreased cervical and lumbar lordosis. Shringohydromelia cavity of stable size and appearance was observed with previous imaging (Fig 2).

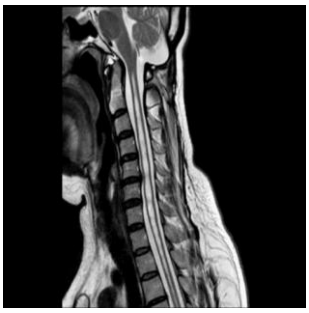

Figure 2: At Six years the postoperative cervical spine & brain sagittal section MRI

The patient applied to our clinic in the 6th postoperative year with headache, neck pain and right arm numbness symptoms. The Pressure Pain Threshold (PPT) was evaluated by a digital algometer (Wagner FPIX, USA) from three areas, the upper Trapezius (1.35 kgF), infraspinatus (3.67 kgF) and C3-4 (1.23 kgF) [6]. Deep cervical flexors were evaluated by the cranio-cervical flexion test (Stabilizer ™, Chattanooga Group USA) [7]. The performance index was recorded as 6 since the patient was able to do three times with a 2 mmHg increase, maintaining it for 10 seconds [8]. Grip and pinch strength were measured by hand-held dynamometer JAMAR (model J00105, Lafayette Instrument Company, USA) [9]. The gripping force was 16 kg and 20 kg for the right and left sides, respectively. The Lateral, double and triple grips were recorded as 6-7 kg, 3.5-5 kg, 5-7 kg, respectively, for the right-left side. Static balance was evaluated by Single Leg Balance Test [10]. The score for the right and left sides was 30 seconds, which was the stop criterion for the test, with the eyes open. When the eyes were closed, the score was 3 and 3.28 sec for the right and left sides, respectively. Gait analysis was performed using the OptoGait (Version 1.6.4.0, Microgate, Italy) [11] (Table 1). Patient consent was obtained for this study.

Table 1: Pre-treatment and Post-treatment gait analysis

	Mean ± Standart Deviation	
	Pre-treatment	**Post-treatment**
Stride length (cm)	147±48.4	165.3±42.6
Gait cycle (sec)	0.909±1.087	1.782±0.486
Cadence (steps/min)	107.1±208.2	82.4±116
Average speed (m/sn)	0.84±1.32	1.01±0.391
Total double support (%)	9.0±10.8	22.9±10.3

Intervention

Suboccipital release technique was applied in supine position according to the literature. Physiotherapist applied pressure and gentle traction to the suboccipital region [12]. During this technique, the patient was asked to close his eyes to prevent eye movements from affecting the suboccipital muscles. The suboccipital relaxation technique was applied for about five minutes (Figure 3). Then, stabilization exercises were given to the patient gradually according to the literature [13]. Stabilization exercises were completed in three stages as static, dynamic and functional. The patient was asked to perform each movement for 10 seconds and 10 repetitions, combined with diaphragmatic breathing. The exercises included workouts handling the supporting technique in neurodevelopment stages (supine, prone, quadrupedal, bipedal) for the cervical part of the spine. Initially, the exercises performed in these four positions were combined with different positions and limb movements (Figure 4). The patient was treated for 10 weeks and three days a week. It was asked to continue exercising at home.

Figure 3: Suboccipital release technique

Figure 4: Cervical stabilization exercises

Post-Treatment Evaluation

After the treatment, the patient stated that the use of painkillers decreased to once a month. PPT was measured as 3.45 kgF for upper trapezius, 5.65 kgF for infraspinatus and 3.02 kgF for C3-4. Deep cervical muscle strength was 6 mmHg and the performance index was 60. The gripping force was 21 kg and 24 kg for the right and left, respectively. The lateral, double and triple grip was recorded as 8-9, 6-6, 7.5-7.4 for the right and left sides, respectively. Single Leg Balance Test score was 24sec and 18sec for the right and left sides, respectively, with the eyes closed. The results of the gait analysis are given in Table 1.

DISCUSSION

To our knowledge, this study is the first study in the literature that has investigated the effectiveness of suboccipital release technique and spinal stabilization exercises in a patient with decompressive surgery due to Chiari malformation and syringomyelia and who had spinal degenerative changes. Post-treatment PPT decreased clinically significantly, while grip force, static balance and gait parameters improved.

In the literature, it is stated that the most effective surgical method in individuals with Chiari malformation is bone decompression and duraplasty [14]. However, after the surgery, pathology may recur as well as symptoms [15]. In our patient, symptoms, such as headache, spreading neck pain, dizziness, and balance disorder, were repeated. After the suboccipital release technique and spinal stabilization exercises, the symptoms of the patient decreased significantly. Suboccipital release technique is thought to restore normal flexibility and autonomic function of the cervical muscles, improve pain perception and increase facial mobility [16, 17]. It is frequently used in cases considered to be related to the cervical region, such as nonspecific neck pain [18], occupational mechanical neck pain, tension-type headache and singultus [19]. Rodrigez *et al*. (2018) stated that the myofascial relaxation technique is more effective on PPT than traditional physiotherapy [20]. In our study, we also think that this technique has a significant effect on reducing PPT and head pain attacks. In addition, we think that the use of painkillers decreases from once a week to once a month is a very important development concerning both possible side effects of the drug and health expenditures.

The cervical stabilization exercises activate the deep cervical flexors to maintain normal cervical lordosis and cervical stabilization without increasing pain. These exercises are known to be effective in reducing symptoms in many pathologies related to cervical region [16, 21, 22]. To our knowledge, there is not any research in the literature that examined the effectiveness of cervical stabilization exercises in patients with Chiari malformation. In the patient in this study, we determined that deep cervical flexor muscles increase strength and endurance. We suggest that maintaining cervical stabilization after decompressive surgery will highly likely to reduce the likelihood of recurrence of symptoms.

The cervical stabilization exercises are known to have also positive effects on neck proprioception [23] (Sharma, Sen, & Dhawan, 2014) (Sharma, Sen, and Dhawan, 2014). Improvement in proprioception, static balance and walking time distance characteristics may have contributed to the development of the patient. Despite the increase in walking speed, the decrease in cadence may be due to the increase in double-step length.

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CONCLUSİON

In conclusion, suboccipital release and stabilization exercises could be safe and effective in the patient who underwent decompression surgery due to Chiari malformation. Further studies with long-term follow-up are needed for the possible preventive effects of these positive effects on the recurrence of symptoms.

Conflict of Interest

We have no conflict of interest to declare.

Author's Contribution

Exercise follow-up, suboccipital release, interpretation of results, article writing: Yasemin Özel Aslıyüce. Planning the study, interpretation and article writing: Özlem Ülge.

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