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ARAŞTIRMA / RESEARCH

Effect of the gaze direction recognition task on pain intensity, range of motion and isometric muscle endurance in chronic neck pain

Kronik boyun ağrısında bakış yönü tanıma egzersizlerinin ağrı şiddeti, eklem hareket açıklığı ve izometrik kas enduransına etkisi

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Abstract

Purpose: The aim of this study was to evaluate the effect of the Gaze Direction Recognition Task on pain intensity, range of motion and isometric muscle endurance in patients with chronic neck pain.
Materials and Methods: A total of 40 participants (32 female, 8 male) aged between 29-54 years (mean age: 44.98 ± 6.38) participated voluntarily in our study. Participants were randomly divided in two groups (GDRT Group and Control Group). Both groups underwent combined physiotherapy program. Both groups received in total 15 sessions of therapy during 3 weeks, 5 days per week. The GDRT Group has additionally underwent 15 sessions of Gaze Direction Recognition Tasks. Pain Intensity (Visual Analog Scale), range of motion (universal goniometer), isometric muscle endurance (craniocervical test) and the Gaze direction recognition task assessments were repeated before, after and 6 weeks after the treatment programme.
Results: After therapy, improvement was observed in terms of pain intensity, flexion, extension, lateral flexion, left rotation range of motion and isometric muscle endurance in both groups ($p<0.05$). Statistically significant differences were recorded in terms of pain intensity, flexion, lateral flexion of both direction, right rotation range of motion, muscle strength and gaze direction recognition task scores between two groups ($p<0.05$).
Conclusion: The Gaze Direction Recognition Tasks given additionally to the combined physiotherapy program has increased the efficiency of the treatment.
Key words: Gaze direction recognition task, ain intensity, chronic neck pain

Öz

Amaç: Çalışmamızın amacı kronik boyun ağrılı olgularda bakış yönü tanıma egzersizlerinin ağrı şiddeti, eklem hareket açıklığı ve izometrik kas enduransına etkisini araştırmaktır.
Gereç ve Yöntem: Çalışmamıza yaşları 29-54(yaş ort:44.98±6.38) arasında değişen toplam 40 katılımcı (32 kadın, 8 erkek) gönüllü olarak katılmıştır. Katılımcılar randomize olarak iki gruba (BYTE Grubu ve Kontrol Grubu) ayrılmıştır. Her iki tedavi grubuna kombine fizyoterapi programı uygulanmıştır. Her iki grup haftada 5 gün ve 3 hafta olmak üzere toplam 15 seans tedaviye alınmıştır. BYTE Grubuna ilave olarak 15 seans Bakış Yönü Tanıma Egzersizleri uygulanmıştır. Ağrı şiddeti (Görsel Analog Skalası), eklem hareket açıklığı (üniversal gonyometre), izometrik kas enduransı (kraniyoservikal test), Bakış yönü tanıma test değerlendirmeleri tedavi öncesi, sonrası ve 6 hafta sonrasında tekrar edilmiştir.
Bulgular: Her iki grupta tedavi programı sonrasında ağrı şiddeti, fleksiyon, ekstansiyon, lateral fleksiyon, sola rotasyon eklem hareket açıklığı, izometrik kas enduransı bakımından iyileşme kaydedilmiştir ($p<0.05$). İki Grup arasında ağrı şiddeti, fleksiyon, her iki yöne lateral fleksiyon, sağa rotasyon eklem hareket açıklığı ve kas endurası ve bakış yönü tanıma test skorları bakımından istatistiksel olarak anlamlı fark kaydedilmiştir ($p<0.05$).
Sonuç: Kombine fizyoterapi programına ilave olarak uygulanan Bakış Yönü Tanıma Egzersizleri tedavinin etkinliğini artırmıştır.
Anahtar kelimeler: Bakış yönü tanıma egzersizi, ağrı şiddeti, kronik boyun ağrısı

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INTRODUCTION

The neck pain is a common musculoskeletal injury which results in severe disability and requires high therapeutic costs. Incidence of neck pain is gradually increasing. Annual incidence varies between 10% and 21%[1]. The prevalence in our country is 13% for female and 9% for male[2]. The pathologies which cause chronic neck pain are; whiplash injury, cervical radiculopathies, cervical spondylosis, cervical disc disorders and myofascial pain syndrome[2,3].

The conventional therapies for neck pain include the exercise therapy, electrotherapy, manipulation, massage, acupuncture, traction, low level laser therapies, magnetic stimulation, miscellaneous pillows, relaxing, cognitive behavioral therapies, cervical collar and biopsychosocial rehabilitation[4]. The patient may be subjected to a special therapy program as well as a standard therapy protocol for the treatment of chronic neck pain[5]. It is determined that; %92,6 of the physiotherapists prefer to use combined (active and passive) methods for treatment of neck pain[6]. However the efficiency of such therapies is not fully explained yet[7].

The findings proving that chronic pain causes alterations in brain structures are gradually increasing[8]. Incongruence of the sensorimotor cortical processing network causes long-term continuation of peripheral pain and leads to chronic pain conditions[9]. Mirror therapy, motor imagery programming and the virtual reality visual feedback therapy are among the modalities which may be used for the treatment of sensorimotor incongruence of limb pain[10]. Chronic pain is caused by conflict from the visual feedback and proprioceptive representation of the affected extremity and the mental exercise modalities activates cortical networks of the affected extremity by correcting this sensory motor incongruences. While these therapies are effective for the treatment of chronic limb pain, they are not effective for relieving chronic neck pain.

In order to change the gaze direction, the head and neck requires coordinated work. According to the sensorimotor incongruence, the reason of the long term neck pain is the incongruence between the sensorimotor conflict from the cortical network areas created by the gaze direction and the sensorimotor feedback. It is therefore possible to alleviate the neck pain by changing the gaze direction and adjusting the sensorimotor incongruence. The gaze direction recognition tasks based on the principle of observing the neck rotation performed by another individual and try to recognize the gaze direction with reference to neck movements has been developed to that end[11].

During this task the subjects observe the neck rotation of another individual sitting in front and attempt to recognize the direction of gaze. In this procedure patients with chronic neck pain were encouraged to experience mental motor imagery. During the motor imagery, activations associated with the movements in the pre-motor area, supplemental motor area and primary motor area as they have been real movements are observed[12]. Observing the movement of another individual activates the mirror neuron systems located in the temporal sulcus, supramarginal gyrus and premotor cortex[13]. The analysis of the cortical blood circulation after the gaze direction recognition task indicates a significant increase of the oxygenated hemoglobin in the related cortical areas[14].

The purpose of our study, in the light of these neurophysiologic principles, is to research the effect of the gaze direction recognition task on pain intensity, range of motion and isometric muscle endurance on chronic neck pain patients.

MATERIALS AND METHODS

Study design and subjects

40 volunteers from Denizli State Hospital, Physiotherapy and Rehabilitation Clinic who were diagnosed by the Physiotherapy and Rehabilitation Specialist with chronic neck pain and were referred to physiotherapy and rehabilitation unit were recruited to our study.

This study has been approved on 08.03.2016 with the letter number 60116787-020/16705 by the Ethical Committee of Noninvasive Clinical Studies of Pamukkale University.

Inclusion criteria were being between 25-55 years of age, presence of neck pain lasting for 3 months and more, subjects having minimum 10% limitation in performing neck rotation, without any known any neurological and psychiatric disorders (SVH, ataxia, postural hypotension, visual disorder etc.) and congenital anomaly and having no contraindication of the physiotherapy modalities to be employed. All subjects accepted to participate into the study.

Individuals with sensory impairments, pacemaker, patients who have balance disorders (cervical radiculopathy, history of cervical surgery etc.) and pregnants were excluded. According to these criteria 150 subjects were scanned between January-March 2016 and 55 subjects who met our criteria were recruited. However the study was finished with 40 subjects (Figure 1).

The subjects were, by means of closed envelope, randomly separated into 2 groups consisting 20 persons. Group 1 is named as Gaze Direction Recognition Task Group (20 subjects) whereas Group 2 is referred to Control Group (20 subjects).

Assessment scales

The demographics of the subjects were recorded. All participants were measured before, after the treatment programme and 6 weeks after the last therapy session. Pain intensity at rest was assessed by Visual Analog Scale (VAS), range of motion was measured using Goniometer, isometric muscle endurance of deep neck flexors by Craniocervical Flexion Test and the gaze direction recognition by Gaze Direction Recognition Task.

Visual Analog Scale (VAS)

Pain Intensity: has been assessed through the Visual Analog Scale (VAS). The participants were asked to mark their pain intensities on 10 cm line placed horizontally[15].

Measurement of the Active Range of Motion

The participants were asked to sit in order to maintain a straight head and trunk posture and the range of motion was measured with 360 degrees universal goniometer in the flexion, extension, rotation and lateral flexion. The acromion was defined as the reference axis for the measurement of the cervical flexion and extension ranges. While the stable arm was parallel to the ground the moving arm followed the middle line of the ear. For the measurement of the lateral flexion range; the moving arm followed the spinous process of the cervical vertebra while the stable arm to be placed to the spinal protrusion of pivot C7 was parallel to the ground. For the measurement of the rotation the pencil introduced in the mouth of the participant was selected as the moving arm and the stable arm was kept parallel to the ground and the middle of the head was selected as pivot[16].

Isometric muscle endurance

The isometric muscle endurance of the cervical flexors was measured with the collar of the sphygmomanometer. While the participants were in the supine position the neck was maintained in the neutral position and the collar was placed under the occiput. The collar was pumped up to 20 mmHg and the participants were taught to make craniocervical flexion with this unit and time was granted for the exercise. The craniocervical flexion was required at 5 different pressure levels (22 mmHg, 24 mmHg, 26 mmHg, 28 mmHg and 30 mmHg) after making sure that the exercise is performed correctly. The best score of the patient at these levels of pressure was recorded. The participant maintained this posture during 10 secs without any movements. 30 secs resting time was allowed between each level. The test was ended when compensatory movements of the participant was observed or when the position could not be maintained for 10 secs[17].

Gaze Direction Recognition Task

The participant was asked to sat on a chair behind the experimenter and to observe the changing neck rotation while following the gaze of the experimenter. Six blocks numbered 1 to 6 were placed in regular intervals on a table of 1800x4000mm. An assistant to the experimenter sat 70 cm behind the table and the participant was asked to sat on a fixed chair without back support 75 cm behind the assistant. The assistant made randomly neck rotations and deliberate eye movements and looked 30 times to these 6 blocks. For each gaze the participant was asked to try to recognize and tell as soon as possible to which block the assistant looked. During the assessment the test started upon the start instruction of the experimenter and the experimenter recorded the reaction time and the accuracy of the block. The average value of the reaction time was recorded as msn and the accuracy score and the number of blocks correctly guessed. During the test, the participants were informed to maintain a stable trunk position[11].

Therapy procedure

In total 15 sessions of physiotherapy were applied to both groups (Group 1: Gaze Direction Recognition

Task (GDR Task), Group 2: Control Group) during 3 weeks, 5 days per week.

The GDR Task Group (Group 1); received conventional physiotherapy programme including 20 mins hot-pack application to the cervical area, 20 mins TENS and 5 mins Ultrasound (US) application and therapeutic exercises (joint range mobility exercises, posture exercises and isometric exercises). In addition to this treatment programme, Gaze Direction Recognition Task based on the same protocol with the Gaze Direction Recognition Test procedures was received. The exercises were applied in 15 sessions totally during 3 weeks as 5 sessions per week. The Control Group (Group 2); received only conventional physiotherapy program. After the therapy program the participants from both groups were advised to continue home exercise program and they were reassessed 6 weeks after their last therapy session.

Exercise program

The range of motion exercises were given for anterior, posterior, lateral and rotation direction. The posture exercises included the shoulder circumduction, scapular adduction exercises and stretching the pectoral muscles. At the end of 3 weeks therapy the isometric exercises were followed up with therapeutic home exercise program. All the exercises were asked to be repeated in 10 sets 3 times per day. The Gaze Direction Recognition Task developed by Nobusaka et al was used in our study. The task which was performed in the same procedure with the test was applied in 30 trials during 10 mins[11]. After discharge the participants were called by telephone 1 time per week and asked whether they were performing their exercises or not.

Statistical analysis

All statistical analyses were performed using SPSS 21.0 software. Shapiro–Wilk's test was used for determination of normal distribution. Continuous variables were defined by the mean ± standard deviation. Mann–Whitney U test and Independent Samples t test was used for comparing two independent groups. Repeated Measures ANOVA and Friedman Test were used for comparing three dependent groups. Differences between categorical variables were made using chi-square test[18]. Significance was set at $p<0.05$.

RESULTS

40 subjects with chronic neck pain between ages of 29 and 54 were included in our study. The participants have been divided randomly into 2 groups. The average age of the GDRT Group (Group 1) is 43.95±7.14 years and their BMI's is 27.68±5.26 kg/m². The average age of the Control Group (Group 2) is 46±5.52 years and their BMI's is 29.16±3.86 kg/m². The groups are homogeneous with the exception of the extension, right and left neck rotation (Table 1).

Table 1. Demographic and baseline characteristics of participants

Variables	GDR Task Group (n=20) X±SD	Control Group (n=20) X±SD	p
Age (Years)	43.95±7.14	46±5.52	0.316*
BMI (kg/m²)	27.68±5.26	29.16±3.86	0.315*
Pain İntensity (VAS) (cm)	5.69±1.59	5.7±1.48	0.984*
Neck Flexion(⁰)	36.55±7.96	39.05±7.26	0.306*
Neck Extension(⁰)	38.25±12.5	50.25±15.2	0.01*
Neck Lateral Flexion(⁰) (Right)	28.9±7.17	27.45±5.19	0.62**
Neck Lateral Flexion (⁰) (Left)	28.9±7.1	29.9±7.1	0.66*
Neck Rotation (Right) (⁰)	41±7.81	53.9±10.43	0.000*
Neck Rotation (Left) (⁰)	45.05±10.35	52.5±11.26	0.036*
Craniocervical Flexion Test (mm- Hg)	24.2±3.04	24.8±3	0.502*
Gaze Direction Recognition Test (Number of correct estimation)	19.1±5.87	20.35±3.2	0.408*
Gaze Direction Recognition Test (Reaction time)(sec)	2.02±0.5	1.87±0.39	0.281*

* Independent Samples t test; ** Mann Whitney U test

In both groups, 16 (80%) of the participants are females and 4 (20%) of are males. 50% of the participants in Group 1 (n=10) and 55% of the subjects in Group 2 (n=11) didn't receive treatment because of neck pain before. 95% of the participants in Group 1 (n=19) and 75% of the subjects in Group 2 (n=15) had no exercise training habits (Table 2).

Table 2. Descriptive data of the participants

Variables	**Group 1 (n=20)** **n (%)**	**Group 2 (n=20)** **n (%)**	**Total (n=40)** **n (%)**
Gender			
Female	16 (80)	16 (80)	32 (80)
Male	4 (20)	4 (20)	8 (20)
Previous Treatment			
Medicine	3 (15)	1 (5)	4 (10)
Physiotherapy	6 (30)	4 (20)	10 (25)
Surgery	1 (5)	2 (10)	3 (7.5)
Medical+ Physiotherapy		2 (10)	2 (5)
No	10 (50)	11 (55)	21 (52.5)
Exercise Habits			
No	19 (95)	15 (75)	34 (85)
1-2days per week	1 (5)	4 (20)	5 (12.5)
Everyday		1 (5)	1 (2.5)

In both groups, pain intensity at rest, Group 1 (p=0.000) and Group 2 (p=0.000), have decreased significantly after the intervention (Table 3). When the pairwise comparisons were examined, statistically significant differences were observed between before and after the treatment and also between immediately after the treatment and 3 weeks later than. In Group 2; the pain intensity at rest has decreased statistically significantly at 6 weeks after treatment when compared before treatment. The flexion range of motion has increased significantly in Group 1 (p=0.000) and Group 2 (p=0.021) (Table 3). Statistically significant differences were observed between before and after the treatment, and between before and 6 weeks after treatment. Statistically significant differences were observed between immediately after the treatment and 6 weeks after treatment and between before and after 6 weeks after treatment in Group 2.

Extension, right lateral flexion and left rotation of neck have increased in the both group (Table 3). Comparing before treatment; this difference was observed between after the treatment and 6 weeks after treatment in both groups. Statistically significant increase was found in left lateral flexion range in both groups. While this difference was observed at all measurements in Group 1, it could be observed only before and immediately after the treatment at Group 2. No significant increase was found in lateral flexion range in Group 2. İsometric neck muscle endurance increased statistically significantly in both groups Group1 (p=0.000) and Group 2 (p=0.032) (Table 3). This increase was observed between before and immediately after and 6 weeks after the treatment in Group 1. It is observed between before and 6 weeks after treatment in Group 2.

The number of the correctly guessed directions of gaze has statistically significantly increased and the reaction time has statistically significantly decreased in Group 1 (Table 3) at The Gaze Direction Test scores after the intervention. When pairwise comparisons are examined, comparing before treatment; accuracy score was increased significantly between after and 6 weeks after the treatment, but reaction time has decreased statistically significantly.

Examining delta scores between before and 6 weeks after treatment; statistically significant differences was observed in terms of pain intensity at rest (p=0.021), flexion (p=0.016), right lateral flexion (p=0.009), left lateral flexion (p=0.001), right rotation (p=0.000) range of motion and isometric muscle endurance (p=0.004) between two groups (Table 4). In other words, it has been determined that the Gaze Direction Recognition Task applied additionally to the combined physiotherapy is superior to the combined physiotherapy program in terms of pain intensity, flexion, lateral flexion, right rotation range of motions and isometric muscle endurance

Table 3. Comparison of before, after and 6 weeks after treatment scores of pain intensity, range of motion, neck muscle endurance and gaze direction recognition test.

Variables	Group 1 (n=20) X±SD			p	Group 2 (n=20) X±SD			p
	Baseline (1)	After treatment (2)	6 weeks after last session (3)		Baseline (1)	After treatment (2)	6 weeks after last session (3)	
Pain Intensity (VAS)	5.69±1.59	3.23±1.8	2.62±1.56	p=0.000* p=0.000 (1-2) p=0.000 (2-3)	5.7±1.48	4.78±1.96	4.02±1.51	p=0.001* p=0.003 (1-3)
Neck Flexion (^{0})	36.55±7.96	41.4±8.35	43.8±6.65	p=0.000** p=0.000 (1-2) p=0.000 (1-3)	39.05±7.26	40±7.06	42.4±6.33	p=0.021* p=0.038 (1-3) p=0.043 (2-3)
Neck Extension (^{0})	38.25±12.5	47.75±10.54	56.05±10.8	p=0.000** p=0.01 (1-2) p=0.000 (1-3)	50.25±15.2	57.2±14.44	62.95±15.52	p=0.000** p=0.005 (1-2) p=0.000 (1-3)
Neck Lateral Flexion (^{0}) (Right)	28.9±7.17	34.65±5.71	38.2±5.91	p=0.000** p=0.022 (1-2) p=0.000 (1-3)	27.45±5.19	31±4.16	30.3±4.7	p=0.001** p=0.002 (1-2) p=0.043 (1-3)
Neck Lateral Flexion (^{0}) (Left)	28.9±7.1	36.5±7.98	40±5.71	p=0.000* p=0.003 (1-2) p=0.000 (1-3) p=0.017 (2-3)	29.9±7.1	32.5±7.52	33.00±6.59	p=0.003** p=0.005 (1-2)
Neck Rotation (Right) (^{0})	41±7.81	52.35±11.23	57.2±11.8	p=0.000* p=0.000 (1-2) p=0.000 (1-3)	53.9±10.43	56.25±11.14	56.7±11.25	p=0.389*
Neck Rotation (Left) (^{0})	45.05±10.35	55.2±11.82	62.1±11.31	p=0.000* p=0.000 (1-2) p=0.01 (1-3) p=0.000 (2-3)	52.5±11.26	57.65±10.11	62.9±10.47	p=0.000* p=0.044 (1-2) p=0.004 (1-3) p=0.046 (2-3)
Craniocervical Flexion Test (mm- Hg)	24.2±3.04	26.7±2.37	27.5±2.42	p=0.000** p=0.013 (1-2) p=0.000 (1-3)	24.8±3	25.2±3.14	26±2.68	p=0.032** p=0.098 (1-3)
Gaze Direction Recognition Test (Number of correct estimation)	19.1±5.87	24.5±3.84	24.35±4.14	p=0.000* p=0.001 (1-2) p=0.000 (1-3)	20.35±3.2	23.75±3.39	20.7±3.17	p=0.815*
Gaze Direction Recognition Test (Time)(sec)	2.02±0.5	1.63±0.29	1.67±0.25	p=0.001* p=0.019 (1-2) p=0.031 (1-3)	1.87±0.39	1.87±0.46	1.92±0.45	p=0.901*

*Repeated Measures ANOVA ; ** Friedman test

Table 4. Delta scores of before and 6 weeks after treatment measurements

Variables	Group 1 (n=20) Δ	Group 2 (n=20) Δ	p
Intensity of pain (VAS) (cm)	3.06±1.67	1.68±1.96	0.021*
Neck Flexion(^{0})	7.25±4.06	3.4±5.53	0.016*
Neck Ekstension(^{0})	17.8±12.49	12.7±9.69	0.157*
Neck Lateral Flexion (Right) (^{0})	9.3±8.21	2.8±5.65	0.009**
Neck Lateral Flexion (Left) (^{0})	11.1±8.55	3.15±5.66	0.001*
Neck Rotation (Right) (^{0})	16.2±11.05	2.75±10.95	0.000*
Neck Rotasyon (Left) (^{0})	17.05±10.18	10.4±12.34	0.071*
Craniocervical Flexion Test (mm- Hg)	3.3±2.36	1.2±1.88	0.004**
Gaze Direction Recognition Test(Number of correct estimation)	5.25±4.43	0.35±2.58	0.000*
Gaze Direction Recognition Test(Time)(sec)	-0.35±0.55	0.05±0.53	0.024*

* Independent Samples t test; ** Mann Whitney U test

DISCUSSION

Adding The Gaze Direction Recognition Tasks to combined physiotherapy program have significantly improved pain intensity at rest, flexion, lateral flexion and right rotation motion and the isometric muscle endurance of neck pain patients. The results obtained from our study will enlighten physiotherapists on a new exercise method. Although the brain lacks nociceptors, the chronic pain may alter the brain functions significantly[19]. While the alterations produced by the mild pain are not clinically taken into consideration, the long term persistent pain may be felt by the patient as an electrical shock with no certain location even if the underlying tissue damage is improved[8]. The studies reported that the cranial circulation is functionally restructured and the structural mapping is rearranged in case of chronic pain[20]. The motor imagery is one of the approaches which ensure the reorganization of the altered brain structures. Thus in our study we employed the Gaze Direction Recognition Tasks based on the motor imagery principle and we planned to inhibit the chronic pain and the associated symptoms. As a result; adding the Gaze Direction Recognition Task to the combined physiotherapy program has decreased pain intensity more at rest. According to the study of Nobusako et al; the Gaze Direction Recognition Task decreased pain during the rotation of the neck[11]. Also it has been indicated that the motor imagery decreased the complex regional pain syndrome and the phantom pain[21]. The results of our study were in accordance to the literature.

Any organic disorder such as cervical spondylosis and cervical disk hernia firstly triggers the pain and then causes limitation of movement. It causes compensatory movements in order to decrease the pain. Such kind of compensatory muscle movements trigger the painful spasms in the neck and strengthen the pain spasm cycle Which causes an alteration of the motor programming in the cortical motor process. After the underlying organic issue is eliminated, the cortex should be properly programmed in order to eliminate the pain. For this reason, it is important to develop range of motion in addition to the pain relief interventions in musculoskeletal system problems. The literature includes limited data indicating that the motor imagery increases the active range of motion[22]. In our study we observed that the Gaze Direction Recognition Tasks applied in addition to combined physiotherapy increased the range of motion. The reason of such increase is the decrease of the pain along with the GDRT is to increase range of motion. Yue et al reported that the motor imagery increased the hypothenar muscle strength in the left hand[23]. The electromyographic studies showed that the main issue of neck pain patients is that the cervical muscles get tired quickly24. In our study we examined the effect of the GDRT on isometric muscle endurance and we saw that it increased the isometric muscle endurance. The literature scanning revealed no study on the effects of motor imagery to the muscle endurance. In this sense we believe that our study will contribute significantly to the literature as the first study.

Observation of the neck rotation of healty individual (never has neck pain) may produce neural motor image and activate the brain's representation areas specific to the neck[13]. We observed that, the reaction time decreases during estimating neck rotation of another subject and that the number of the correct prediction increases in chronic neck pain patients. No changes were recorded in terms of the number of the correct prediction and reaction time at the group to which the GDRT was not performed. The motor imagery applied additionally caused the increase of activation of the neck specific representation areas in the brain. This indicated that the motor imagery resulted in the increase of the brain activation at the individuals with the neck pain as it is with the healthy individuals. The findings obtained from our study planned based on the hypothesis that the Gaze Direction Recognition Tasks based on the motor imagery principles contribute to the cortical improvement have validated our hypothesis.

We all know that the chronic pain decreases the proprioception sense. However the effect of GDRT on the proprioception and the functional activity level was not studied. We believe that further studies need to be done in this area. Also it is suggested to perform studies which will assess the long term effects of this task.

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