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Research Paper: Effect of Corrective Exercises on Cervicogenic Headache in Office Workers With Forward Head Posture

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ABSTRACT

Introduction: Headache is one of the prevalent health problems that impose huge costs on economy. One type of the headache is cervicogenic headache caused by bad posture of cervical spine. To know the effect of corrective exercises on cervical headache by improving range of motion in joints and retraining specific postural muscles like anterior and deep flexor muscles of the neck.

Materials and Methods: Based on inclusion and exclusion criteria, 30 individuals were randomly selected and divided into two groups; control (medicine) and interventional (exercises) groups with 15 participants in each group. A validated digital camera (Cannon A95 PowerShot) was used to determine Forward Head Posture (FHP). The landmarks of the FHP were marked by using white 12-mm markers that included earlobe, C7 spinous process, and acromion process. Patients performed stretching, strengthening, and corrective exercises after receiving training. The obtained data were analyzed by ANCOVA, Mann-Whitney U and Wilcoxon signed-rank tests.

Results: The average difference in the scores of cervical headache in the experimental group was less than that in the control group which was statistically significant (P<0.001). Mean difference in the scores of cervical pain duration among experimental group was less than the control group and this difference was statistically significant, too (P<0.05).

Conclusion: Corrective exercises had shown statistically significant effects on neck disability index, neck pain as well as on the pain intensity, its duration and frequency among office workers with FHP.

1. Introduction

Headache is an extremely common problem which most of the time is mild or infrequent but in severe or frequent types, cause considerable suffering with decrease or abolished working capacity [1]. Epidemiological studies previously conducted in the general population had shown average

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headache prevalence rates of 46% for one year and 64% for lifetime [2]. Cervical joint dysfunction is one of cervicogenic causes of headache and persistent headache is a common symptom after structural changes in the cervical spine [3]. The Headache Classification Committee of the International Headache Society listed impairments in cervical muscles function as the criteria for headaches of cervical spine origin [4]. In normal spine, the line of gravity passes through the concave side of each vertebral arch and in a particular posture, the gravity line causes the creation of torque in the direction of maintained intended position in each vertebral arch [5].

Forward Head Posture (FHP) is an anterior positioning of the head relative to the line of gravity in the sagittal plane. This condition is frequently observed in individuals working with computer for prolonged duration [6]. It has become more prevalent in modern times as the center of gravity shifts in the body posture. For compensation, upper body drifts backward and shoulders slump forward by placing the head anterior to the trunk [7, 8]. Office workers' working behavior in a static sitting posture for long period is liable to adopt poor body posture and thus generating musculoskeletal disorders [9]. It is also caused by several factors including sleeping with head elevated too high, extended use of computers, lack of strength in back muscles, etc. Recently, the widespread use of computers in offices has led to spend more time than that a person spends using a personal computer. These changes may be accompanied by poor posture and the resultant neck pain. The relationship between FHP and neck pain is still debatable. In literature, FHP has not always been associated with neck pain [10].

Other local complications after FHP include increase pressure on blood vessels, low blood supply to brain, hyperactivity of the middle neck region because of loose nuchal ligament, less movement of the upper thorax and reduced respiratory capacity. Prolonged FHP also causes hyperkyphosis, changes in alignment and range of motion in the scapular region [11, 12]. FHP can also produce problems related to the proprioception of muscles, such as mechanoreceptor function, and alter the sensitivity of spindles of the neck muscles mentioned previously, as well as decreasing kinesthetic acuity of neck motions [13].

Different techniques are available to treat or alleviate the headache by targeting the musculoskeletal and biomechanical factors affecting shoulder and neck region [14]. One previous study had also concluded that craniocervical training program was effective in the management of chronic and episodic tension-type headache over a prolonged time frame [15]. As very few studies have discussed the role of therapeutic exercises or corrective posture training on cervicogenic headache patients, the present study was conducted to assess the effectiveness of therapeutic exercises program for cervical headache, to increase the range of motion (ROM) in cervical spine, to increase flexibility and stretching power and postural retraining during activities of daily life.

2. Materials and Methods

This study was approved by the Faculty of Physical Education and Sports Sciences, Karaj Islamic Azad University and performed at a physiotherapy clinic in district 8 of Tehran. Participants were included based on Biondi questionnaire [16] and excluded if they had any kind of vision, hearing, smell, or taste problems. Those who had ear, nose, eye and throat infection which might cause the headache due to inflammatory reasons were also excluded. Participants affected with tension headache, migraine, rheumatic arthritis, infections, inflammations, history of neurological problem or fracture in neck region were also excluded. All the individuals over 60 years were also excluded because of the possibility of osteoarthritis involved.

After filling the consent forms, the participants' demographic data including age, gender, height, weight, average work experience and average number of daily working hours were taken. The head, neck and shoulder regions of all the individuals were assessed and FHP was examined by a validated [17, 18] digital camera (Cannon A95 PowerShot). A fix distance of 120 cm from the camera was maintained for all participants while taking the pictures. The participant was asked to walk a few steps and take deep breath to relax before standing on the marked line. Right lateral view of the head, neck, and upper chest were focused during photography. To confirm the vertical and straight position of the camera, an angle of 90 degree was drawn on the opposite wall by using goniometer. Camera frame was matched with the horizontal and vertical sides. The landmarks of the FHP were marked by using 12 mm white markers. Intended landmarks included earlobe, C7 spinous process, and acromion process.

A small cone shaped cardboard with a base of 2.1 cm and height of 2 cm was pasted on the marked point of C7 spinous process if the point was not visible [17]. After transferring the images into computer, intended angles were assessed with Image J. This software is actually used for editing the pictures but it can also measure the angles among 3 marked points on the computer screen.

Figure 1. Forward head posture

For measuring FHP angle, all the images had the same size and a line was drawn from the earlobe to C7 spinous process. Another line was drawn from the C7 spinous process in the horizontal direction (Figure 1) and measured [17]. This angle was measured three times and its average value was recorded. All these measurements were performed by an expert examiner. The measuring angle for the present research between shoulder and neck was considered as ≤54 degree. Second and third specific questionnaires were also given to the patients. An initial assessment was also performed before final selection of the participants. All participants were randomly assigned in two equal groups (control & experimental) with 15 patients in each group.

Patients were trained about the respiratory exercises of diaphragm muscle by putting 1-kg weight over the belly (i.e. in supine position), below the ribs and asked them to inhale and exhale. Strengthening of diaphragm helps in reducing the load on accessory muscles of respiratory system. Patients were educated about the retraining of transverse abdominal muscles which help in increasing and maintaining the tone of spinal stabilizer muscles. The patients were asked to activate the transvers abdominal muscles while performing stabilizing exercises.

Based on the postural therapeutic strategies of Janda [19], corrective exercises were performed initially by stretching exercises because shortening of the muscles due to bad posture will not empower the stretched muscles. Mechanism of reciprocal inhibition for stretching muscles was initially performed inactively by therapist to reduce spasm and pain with emphasis on contracting-relaxing techniques of manual therapy.

All the stretching exercises were performed initially by the therapist but after training, the patient himself does the stretching for 30 s with four repetitions: 1. The therapist performed the stretching of sternocleidomastoid and scalene muscles while the patient was lying and trained him to perform stretching exercises in sitting position at home. Stretching exercises were arranged and preformed according to the patient's comfort level without increasing headache; 2. Levator scapulae and the upper fibers of trapezius were stretched in lying position by the therapist and in sitting position by the patient himself; 3. Stretching of the small and large muscles of the chest; 4. Stretching of intercostal muscles in standing position; and 5. Stretching of the hamstring and iliopsoas muscles.

First the patients actively performed endurance exercises at physiotherapy clinic and after proper training they performed these exercises at home by using Theraband. Initially, these natural exercises were performed in an isometric manner and later on changed to concentric one; more stress was given on the weak postural muscles: 1. Training and rehabilitation of power and endurance of deep neck flexors muscles of anterior side were the most important corrective exercises. Strengthening exercises were performed in lying, sitting, and standing positions; 2. Strengthening of the lower trapezius and rhomboids muscles were done initially without weight and afterward by using Theraband and dumbells; 3. Strengthening of the shoulder girdle muscles was done by performing isometric exercises with Theraband and then by isotonic exercises; 4. Strengthening of the paravertebral muscles.

The ratio of stretching to power training was as follows: At initial stage, stretching exercises were performed twice compared to the strengthening exercises in order to alleviate the spasm as well as pain and to correct the muscle shortening; At the next stage, both stretching and strengthening training were performed equally because after correction of the muscle shortening and ROM, muscle strength was required to maintain latest correct position; At last stage, the strengthening exercises were performed twice compared to the stretching exercises to maintain the posture under increased pressure.

The patients attended 10 initial treatment sessions three times a week at physiotherapy clinic. Each session was lasted an hour in which stretching exercises were performed on the patients by therapist. Before the start of corrective exercises, the patients performed warm up exercises for 30 s to increase proprioception and blood supply. Mechanoreceptors were stimulated at sacroiliac and cervical region by using vibrator. In the second phase, the patients were reported at clinic for assessment and additional corrective exercises were rendered. The pa-

tients also performed stretching and respiratory exercises for 15 minutes every day, 5 times a week for 8 weeks.

Data analysis

Individual characteristics were explained by descriptive statistics. Severity of headache (normal distribution) was analyzed by parametric test and analysis of covariance (ANCOVA); for descriptive ordinal variables, non-parametric Mann-Whitney U and Wilcoxon signed-rank tests were used to compare the mean difference of pretest and posttest scores of the measured variables. P-values less than 0.05 was considered as "statistically significant" while analyzing the data by SPSS.

3. Results

The control group consisted of 53.3% females and 46.7% males while the experimental group consisted of 60% females and 40% males. The mean (SD) ages of the participants in the experimental and control group were 41.53(6.65) and 42.6(6.95) year, respectively. The mean (SD) height of the participants in the experimental and control groups were 168.26(6.24) and 170.06(9.10) cm, respectively. The mean (SD) weight of the participants in the experimental and control group were 78.53(6.14) and 69.26(7.86) kg, respectively. The participants had an mean (SD) work experience of 14.46(5.69) year in the experimental group and 15.46(5.96) year in the control group. The experimental group used to work daily for an mean (SD) of 8.46(1.12) h while in the control group it was 8.86 (1.54) h.

Demographic data showed no significant difference (P>0.05) between two groups (control & experimental) before corrective exercises. Total number of participants in both groups with headache on one side were significantly more than those with headache on both sides (P<0.05). The average difference in the onset of cervical headache and work experience in both groups showed no significant difference before the start of exercises (P>0.05).

Almost 80% of the participants in the experimental group and 73.3% in the control group reported pain in or around eye balls during headache. In the experimental group, 60% of the participants and in the control group 66.6% of the participants had lost some of their working capacity and shown hypersensitivity during headache but no significant difference was noted regarding these symptoms (P>0.05). Neck disability index and neck pain during activities of daily life showed significant reduction after intervention in the experimental group (P<0.05). Only two people had headache for less than one hour in the experimental group before treatment but 10 persons reported headache for less than one hour after the treatment.

As shown in Table 1, corrective exercises had significant effect on the headaches of patients with FHP. Amount of "F" represents the variable within group, showing the level of significance (P<0.001).

As it was shown in Table 2, the average differences in the scores of cervical headache in the experimental group was less than that in the control group and it was statistically significant (P<0.001); therefore, corrective exercises had significant effect on the cervical headaches of the patients with FHP (Table 2).

As shown in Table 3, mean differences in the scores of cervical pain duration in the experimental group were less than that in the control group and these differences were statistically significant too (P<0.05); Thus , the corrective exercises also had significant and effective role on the duration of cervical pain among FHP patients. As shown in Table 4, mean difference of the repetition and frequency scores of cervical headache was less in the experimental group than control which also had statistically significant difference between two groups (P<0.001). Therefore, it can be conclude d that corrective exercises for cervicogenic headache in the FHP patients had significant effects.

Table 1. Results of ANCOVA showing mean difference of cervical pain between two groups

Variable	Sum of Squares	df	F	P	n2
Within group	597.515	1	49.274	0.000	
Pretest	204.320	1	18.849	0.000	0.646
Error	327.414	27	-	-	0.384
Total	957.367	29	-	-	

Table 2. Results of Mann–Whitney U test comparing the mean difference in cervical pain intensity scores for pretest/posttest between two groups

Variable	Groups	Mean	Mann–Whitney U Test	Z Score	P
Pain intensity	Experimental	9.33	20	-4.167	0.000
	Control	21.67			

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Table 3. Results of Mann–Whitney U test comparing the mean differences in cervical pain duration scores for pretest/posttest between two groups

Variable	Groups	Mean	Mann–Whitney U Test	Z Score	P
Pain Duration	Experimental	12	60	-2.742	0.029
	Control	19			

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4. Discussion

Based on the study objectives, 8-week long corrective exercises with 6-month follow up was performed on the office workers complaining from headache with FHP. The current results have shown that study corrective exercises were significantly effective (P<0.05). Neck disability index and cervical pain was reduced after one session which caused reduction in other symptoms like headache while performing ADL at home and office as well as increase in working capacity.

Results of the present study were similar to findings of Seok Hyun Nam et al. (2013) who aimed to determine the inter- and intra-rater reliabilities of the assessment of FHP. They concluded that assessment of FHP is an important component of evaluation and affects the treatment protocol [20]. Kotteeswaran et al. (2012) conducted a research to determine the effect of stretching and strengthening shoulder muscles exercises in protracted shoulder in healthy individuals. In their study with 30 participants, there was significant reduction in the level of shoulder protraction with the pretest mean (SD) of 9.760(0.338) cm and the posttest mean (SD) of 8.860(0.338) cm (P<0.0001). Results also showed significant effects of corrective movement's exercises on intensity, duration, repetition and number of cervical headache incidences among the office workers with FHP. They concluded that the stretching and strengthening exercises were effective in reducing the protracted shoulder and like present study their study also showed reduction in headache and improvement in neck disability index [21].

The present study has shown reduction in cervical headache intensity in the control group individuals after intervention which is also clear from the Z scores and P values in Table 2. Pain duration of cervical headache presented in Table 3 also shows the significant reduction in the pain duration among 8 participants after intervention. Repetition and frequency of cervical headache variables had maximum positive ratings which indicate the significant reduction of symptoms among 14 participants (Table 4). Similar results were also found in one previous research conducted to access the influential variables associated with outcomes in patients with cervicogenic

Table 4. Results of Mann–Whitney U test score showing comparison of the average difference in cervical pain repetition & frequency for pre and post test between two groups

Variables	Groups	Mean	Mann–Whitney U	Z- value	P
Repetition & frequency of cervical headache	Experimental	10	30	- 3.70	0.000
	Control	21			

JMR

headache. Standardized physical therapy treatment was performed which included spinal mobilization/manipulation and therapeutic exercise, and outcomes of treatment were determined by quantification of changes in headache pain intensity, headache frequency, and self-reported function. They concluded that patient's age, provocation or relief of headache with movement, and being gainfully employed were all factors significantly ($P<0.05$) related to improved outcomes [22].

Corrective exercises had shown statistically significant effects on neck disability index, neck pain, as well as the pain intensity, duration and frequency among office workers with FHP.

Ethical Considerations

Compliance with ethical guideline

All the participants filled the consent form.

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Conflict of interest

All the authors confirm that there are no known conflicts of interest associated with this publication.

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