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# The Effect of Two Selected Exercise Therapy Programs on Neck Pain, Strength and Range of Motion (ROM) of the Neck in Computer Users

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## Abstract

**Purpose:** Chronic neck pain is one of the common problems among computer users. The aim of this research was to compare and evaluate the effect of 8 weeks of a selected exercise therapy program and a self-treatment program based on a given pamphlet on neck pain, strength and range of motion of the neck in computer users.

**Material and Methods:** In this quasi-experimental study, sixty-six patients with chronic neck pain ( age 39.19 ± 3.1 years, height 172.39 ± 4.6 cm and weight 71.68 ± 5.6)who at least had asix-month history of neck pain, were recruited based on a Personal Information Questionnaire distributed among computer users working in banks of Isfahan. The subjects were divided in three groups. The first group carried out therapeutic exercises with the supervision of a trainer, while the second group received a pamphlet and the third group had no intervention. Neck Pain and Disability Scale, dynamometer (power track commander II) and a goniometry device were respectively used to measure neck pain, disability, strength and range of motion in subjects after 8 weeks of intervention. One-way NOVA was applied in order to analysis of data ($P<0.05$).

**Results:** The results showed that there was a significant difference between means of neck pain and disability and, also between neck muscle strength of the study groups ($P<0.021$). Comparison of neck ROM in different groups showed that neck ROM of the selected exercise group in all movements, except for the left rotation, had significant differences with the two other groups. Right rotation of the self-treatment group was significantly different from the control group ($P<0.031$).

**Discussion and Conclusion:** According to the results of this study, it can be concluded that both treatment methods for the chronic neck pain are fruitful, although self-treatment is less costly, selected exercise therapy with a trainer is more manageable, effective and safe.

**Keywords:** Exercise therapy, Chronic neck pain, Self-treatment, ROM

## Introduction

Musculoskeletal deformities refer to anyimpairments in the musculoskeletal and nervous systems, causing dysfunctions in various organs of the body. Today work-related musculoskeletal disorders are increasing in different societies, especially in industrial and developing countries. These include factors that are related to working conditionsand those that are unrelated to these conditions. Some of the riskfactorsare: physical demands and task performance with improper physical conditions, the exerted force, routine movements, the duration of task performance and vibration. Personal risk factors unrelated to work are age, sex, anthropometrical characteristics, muscular strength, physical fitness [3], and psychological-social factors including time, jobstress, lack of social supports, and job dissatisfaction [4]. Among the above mentioned factors, the most important one is incorrect posture.

These deformities are problems related to health and hygiene all around the world that, not only affect the body and the soul, but also lead toa decreasein the output work;from the economical point of view, they cause a decrease in efficiency and are responsible for disablement andmaking absence from work [7,8]. Computer usage in different societies has increased and this technology reduced many physical activities, and results ininactivity among people. The consequence is a decrease inthe range of motion and flexibility in the long run.

All these factors lead tothe beginning of feeling

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pain in different parts of the body [9]. That is why the high prevalence of musculoskeletal problems in different part of the body such as neck, waist, shoulder, hand, wrist, fingers,feet and legs in computer users has been reported by researchers [10, 11, 12]. Pain and its complications is one of these disorders forming the most common disability causing factors among computer users [13,14]. Various researchers revealed the prevalence of neck pain among computer users [10, 11, 12]. In some societies, it is reported to be up to 0.74 [11]. Also Cagnie et al. (2007) reported annual prevalence of neck pain among staff computer users to be %45.5.Several factors can cause neck pain in computer users: hours of working with computer, bad habits, bad body condition, and fatiguewhile working [15]. Moreover, it is also revealed by researches that weakness, muscular atrophy of neck muscles and adaptation to incorrect and improper body conditions are of reasons causingpain and disabilityamong staff using computers in offices;besides strength, endurance and range of motion of patients with chronic neck pain are lower as compared tohealthy people [13, 14].It is reported that muscle weakness in daily life, at work and in activities, can be an important factor for the onset of neck disorders. It was shown that weakness of neck flexors is related to continuation of pain in people with neck pain.Barredo and Mahon(2007),reported that stretching exercises and relaxation techniques in computer sites reduced the musculoskeletal disorders in computer users. One of the commonly recommended advised methods for curing neck pain is using active exercises but their effectiveness has not been proved [19]. Researchers claim that evaluation of strength and range of motion of the neck is a good processfortheevaluationof theeffectiveness of therehabilitation program and a criterion for continual evaluation of exercise program [8, 20]. Therefore the aim of this study wasto survey the effects of eight weeks of selected exercise therapy and self-treatment with pamphlet programs, on neck pain,disability score, strength and range of motion (ROM) of the neck, in patients with chronic neck pain.

## Material and Methods

### *Subjects*

In this cross-sectional,quasi-experimental study, 66 computer users working in banks of Isfahan (age 39.19±3.10, height 172.39±4.6cm and weight 71.68±5.6 kg) were selected using a researcher made questionnaire. The inclusion criteriawere being male,andhavinga history of 6 months of neck pain, and the exclusioncriteriawere doing regular exercises, existence of pain due to trauma, history of surgical operation on spinal column or congenital deformities in cervical spine, special diseases related to musculoskeletal deformities of the neck (arthritisrheumatoid, spinal tuberculosis head and neck cancer). The subjects worked 6 days in a week, 4 hours a day on average, and had at least 7 years of work experience. They did not use medical collar during the study.Out of the 196 bank stafftested, only 86metthe inclusion/exclusion criteria of the study.Nine of the participants had regular exercises andwere omitted from the study. Then the subjects were divided into three groups of self-treatment by pamphlet, selected exercise therapy, and the control group. 25 people were placed in the specific exercise therapy group7 of them left the program for differentreasons. 25 patients were placed in the self-treatment group with pamphlettwo of whomalso left the program.25 of the patients were placed in the control group withoutany regular exercise training or intervention.

### *Measurements*

The measurements were performed by a technician beforeand after the 8-week intervention period.A universal goniometerwas used for assessing the neck range of motion inflexion, extension, lateral flexion, and rotationmovements. In this study, tests of range of motion were administered by an activerange of motion in a sitting position [21].

For measuring isometric strength of the neck muscles in flexion, extension, and lateral flexion movements, a manual dynamometer (power track commander II) was used. Strength tests in this study were done following the instructions in the dynamometer manual. After the neck muscles were warmed up, the patients were instructed the correct way to perform the tests, than they were asked not to use their trunk muscles in conducting the tests, keep the trunk relaxed, and do the actions usingtheneck muscles. Then to learn the test battery, the patients did warm up three times with sub maximal contractions. For measuring the strengthof flexors, extensors and lateral flexors of the neck, the patient lied on a bed with 50 cm

height in supine, prone and side position respectively. The examiner put the dynamometer on the forehead for measuring flexor muscles strength, on occipital process for measuring strength of extensor muscles, and on temporal bone for measuring lateral flexor muscles strength, asking them to perform the actions with maximum effort. The test was performed three times. The highest score recorded by the dynamometer was decided as the strength score in the specific movement.

### *Interventions*

The subjects were randomized into three groups: a therapeutic exercise group (TETG, n = 18), a self-treatment by pamphlet group (STPG, n = 23), and a control group (CG, n= 25). The exercise program of TETGwas designed and performed under the supervision of a physiotherapist and a trainer for 8 weeks, 3 sessions a week,each session 30-45 minutes.The exercises were specially designed so that they were applicable in the work place and were performed at a proper time. Exercise selection and their method of performance were arranged from simple to complex. In the first sessions movements were simpler andlow in intensity, number, repetitions, and duration. Inthe later sessions the intensity of the exercises increased gradually and they became harder.All of the exercises were designed according to the scientific principles of training, including warm up, doing low intensity exercises for about 5 minutes, stretching exercises for 15 to 20 minutesfollowed by15 to 20 minutes ofisometric exercises and 5 minutes of recovery. Exercise time in each session varied between40-60 minutesaccording to eachspecific program.

Training program of STPGconsisted of 10 various isometric stretching and resistance movements of the neck and shoulder girdle forwhich basic points and instructions were stated in a pamphlet. The subjects received the pamphlet after taking part in an instructional session about the correct performance of the movements and the necessary points to be considered. During the research period there were telephone contacts twice a week with the patients in order to supervise and encourage them to follow the program or solve any possible problems.

TheCGgroup received written information and a single guidancesession concerning the same stretching exercisesthat the training group were performing. In order toprevent the groups from influencing one another, the researchers tried to choose the group members from different branches of banks. All of the participants provided written informed consentbefore entering to this research. The study design wasapproved by the ethics committee of Rehabilitation department, medical school of Isfahan, Iran.

### *Data analysis*

The results are expressed as means ±standard deviations(M±SD).For analyzing data, One-way ANOVA was applied ($P<0.05$). Scheffe Post hoc test was used to determine differences between the groups. The α-level was set at 0.05.

## Results

The results of descriptive statistics (Mean ±SD)of the groups are shown in table1.Comparing thepain and disability of subjects in different groups showed that there were significant differences between the meanpre-post testsdifferences in pain and disability of subjects in different movements of flexion, extension, right lateral flexion and left lateral flexion (p=0.005) (figure1).

Multiple comparisons of neck muscles strength in different groups showed that there were significant differences between the meanpre-post tests differences in different movements of flexion, extension, right lateral flexion and left lateral flexion of groups (p=0.005) (figure 1).

**Table1:** Demographic characteristic of subjects(Mean± SD)

| Groups | Age (years) | Weight (kg) | Height (cm) | Duration of neck pain (Months) | Neck pain, mm (VAS, scale 0-100) |
|---|---|---|---|---|---|
| Therapeutic exercise(N=18) | 39.38 ±3.6 | 71.83 ±5.04 | 172.17 ±4 | >8 | 31.34 ±8.82 |
| Self-treatment training program(N=23) | 38.82 ±3.2 | 71.6 ±5.9 | 172.7±4.9 | >8 | 33.70 ±8.38 |
| Control group(N=25) | 39.4 ±2.6 | 71.64 ±5.9 | 172.28 ±4.9 | >8 | 32.89 ±8.37 |

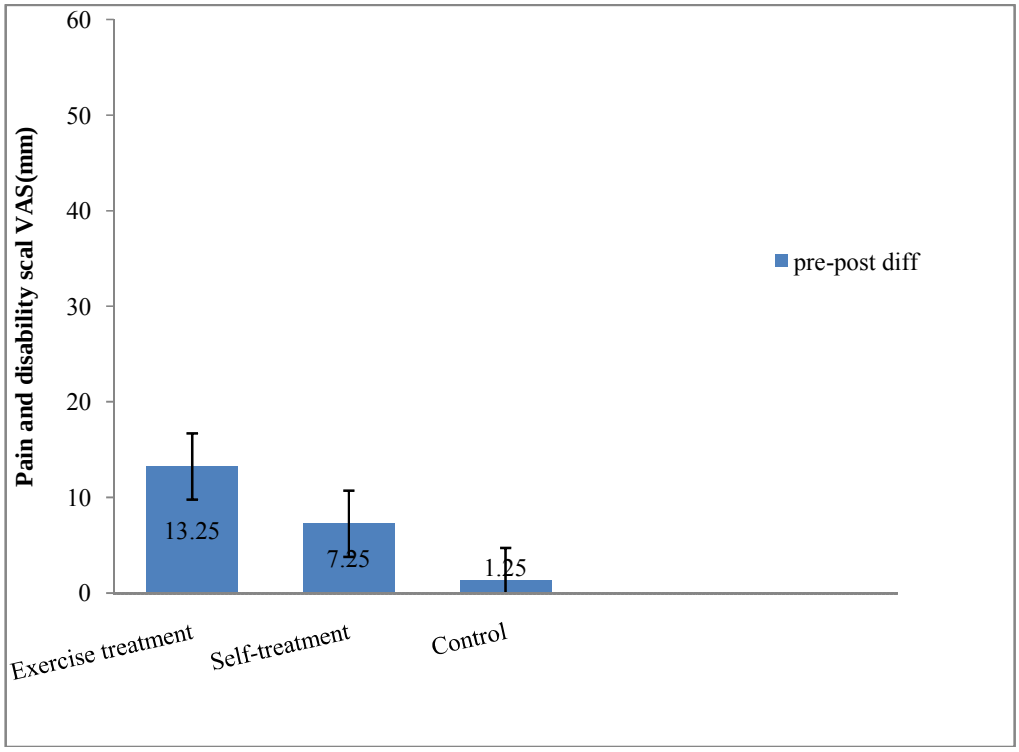


**Figure 1:** Comparison of neck pain and disability in different groups (pre-post test differences)

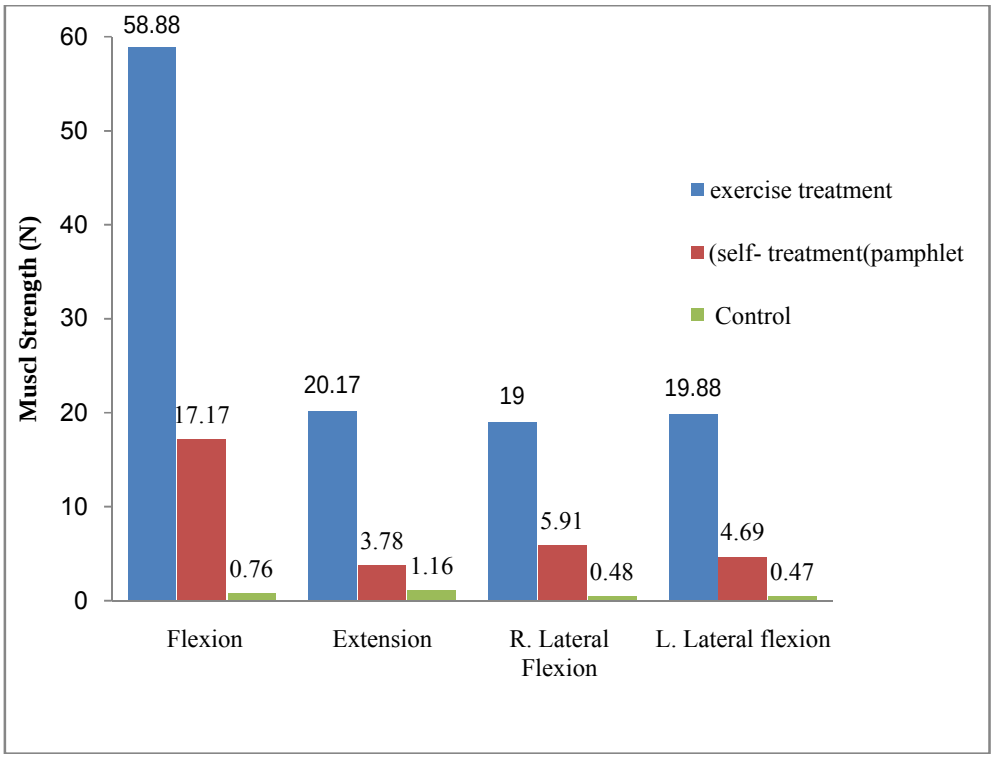


**Figure 2:** Comparison of neck muscle strength in different movements (pre-post test differences)

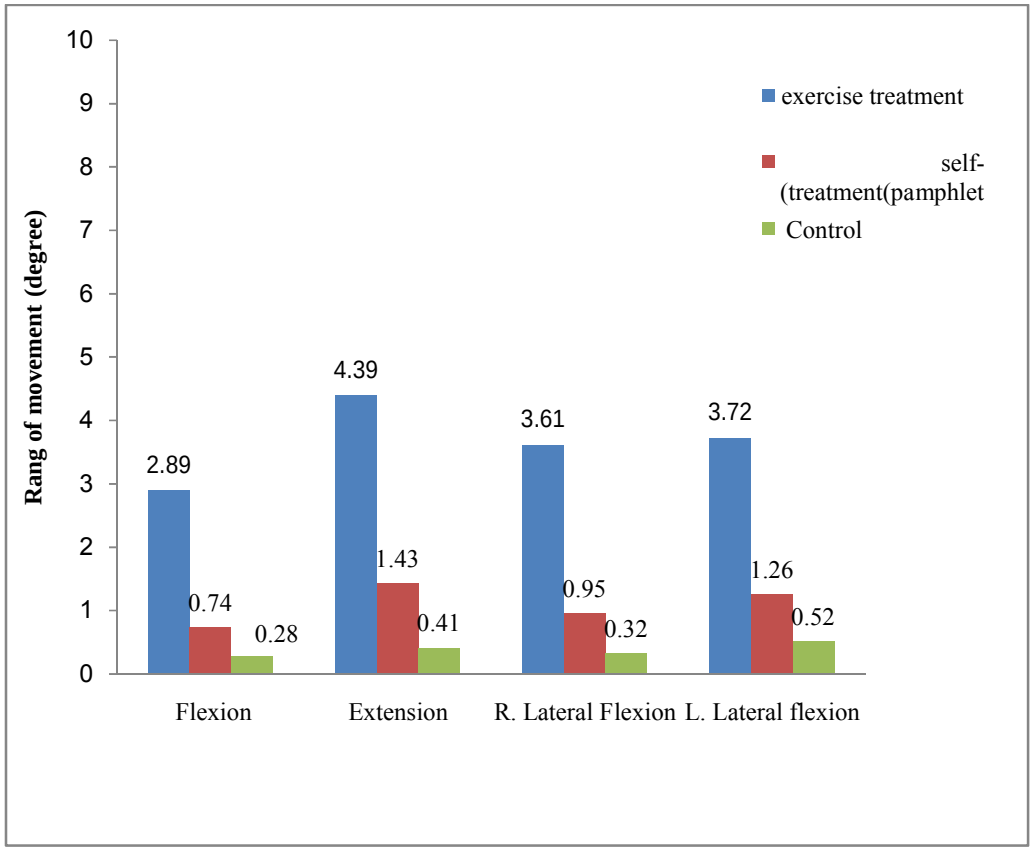


**Figure 3:** Comparison of ROM of groups in different ovements (pre-post test differences)

Moreover the results of post hoc tests in multiple comparison of different groups showed a significant difference between the exercise therapy and the control group, and between exercise therapy and self-treatment by pamphletgroups, in flexion, extension, right lateral flexion and left lateral flexion ($p<0.005$). But there were not any significant differences between self-treatment group by pamphlet and the control group in flexion, extension, right lateral flexion and left lateral flexionmovements ($p>0.05$).

## Discussion

Because of the prevalence of pain and musculoskeletal deformities related to work, today many concerns have been regarded to the science ofergonomic technology and exercise therapy in developed countries. Unfortunately, in developing countries like Iran these studies have been rare. The presentstudy aimed at investigatingthe effects of eight weeks of exercise therapy and self-treatment program by pamphlet, on strength and the range of motion of patients with chronic neck pain, working in the banks of Isfahan, Iran. The results showed more improvements in the muscle strength of the experimental groups as compared tothe control group, and in the selected exercise therapy group as compared tothe self-treatment by pamphlet group. This result agrees with the results ofSoltani et al (1388), Ylinen et al. (2003), Arja Hakin et al. (2008), and Randlo et al (1998).

Soltaniet al. (2000) compared the effects of PNF exercises and traditional exercises on the severityof pain and the strength of flexor and extensor muscles in patients with chronic neck pain. Results of their study showed that in the PNF exercise group strength of neck'sflexorsand extensors increased21.5% and24.6% respectivelyand that this increase was %13.8 and %11.1 in the group with traditional exercise. Neck painreduction in both groups was significant.

Ylinen et al. (2003) studied the effects of resistanceand strength exercises on the treatment of patients with chronic neck pain. They reported that the maximum isometric strength of neck in the group with strengthening exercises increased, in flexion (110%), rotation (76%), and extension (69%). While in the group with endurance exercises

these values were 28%, 29%, and 16% respectively, and in the control group they were 10%, 10%, and 7%. TheRange of motion in neck rotation showed a significant increase in the twoexercise groups,as comparedto the control group. Also there was an increase and a significant improvement intherange of motion in lateral flexion and flexion and extension movements in the group with strengthening exercises.Moreover the neck pain decreased significantly in both groups.

In another study, Hakkinen et al. (2008) investigated 101 patients with chronic neck pain, and observed the effects of the combination of stretching and strengthening exercises on pain, isometric strength and the range of motion of neck muscles and reported that even a low intensity of strengthening and stretching movementscan have positive effects on the chronic neck pain in case they wereperformed for a long time (12 months) [22]. Randlo et al (1998) compared the two methods of light and moderate exercise in thetreatment of two groups with chronic neck pain. The treatment for the first group consisted of shoulder and scapula movements,resistance exercises in the direction of flexion, and extension of the head and the neck against the wall and shoulder and scapula exercises similar to the first group accompanied with resistive exercises of the head against the force to the ground and lateral resistive exercises in the second group. The results of their study showed an increase in the isometric power of flexors(%26 and %22)and extensors (%27 and 44%)of the neck in the first and the second group respectively,with a significant decrease in pain in both groups [23].

Different factors might have been effective in the increase ofthe strength of the neck muscles following the exercise therapy intervention.

Results of different studies reveal that strengthening exercises in people with no exercise experience causean increase in strength due to neuromuscular adaptation [24]. In the present study proper strengthening exercises were used as a part of the training program. Studies showed thatweakness in neck muscles in people with neck pain, as compared with healthy people[8, 13, 16], may be the result of reflexive inhibition due to pain [13, 25, 26]. Since exercise therapy leads to a decrease in pain [19, 22, 23], the resulting reflexive inhibition becomes less; therefore the person can exert more effort. Moreover studies have showed thatpain threshold waslower in patients with chronic pain as compared tohealthypeople [16, 27, 28];asthese patients feel more pain when exerting effort, they don't have the capability of exerting maximum effort. So,maximum effort test scores cannot always bethe proper descriptionfor maximum strength in these people [16]. Since all subjects of the study had chronic neck pain, possibly they could not apply their maximum strength, but after the treatment intervention, due to a decrease in pain, they applied more strength.

One of the possible causes of the increasedstrength inthe neck musclesof thesubjects, may be an increase in blood circulation and consequently more oxygen and food deliveryto the muscular cells. Larson et al (1999) reported that in patients with chronic neck pain, blood flow during contractions in trapezes muscle of the painful side has been reduced [29]. Others reported an increase in the density of the blood vessels in the deltoid muscles, resulting ina decrease in pain level and an increase in muscular strength following resistive exercises.

Results of the study showed a significant development in the range of motion of both groups, in all movements except forturning to left, in self-treatment with pamphlet group. This result is in accordance with that of Ylinen et al. (2003),Arja Hakkinen et al (2008), and Tameka et al (2000).

Taimela et al. (2000) studied 76 patients with chronic neck painand compared the effects of a one-year application of some active treatment methods, and exercise at home. They measured pain disablement, range of motion of cervical spine, and trigger point pain in shoulder, at the beginning of the program, after 3 months, and after 12 months following thetraining intervention. The results showed that the total meanof the values in the active group was higher than that of the other groups and it was higher in home exercise group as compared to the control group [13].

Various studies showed that the neck's range of motion inpeople with chronic neck pain is lower than healthy people, and that the pain causes limitation in movement [32, 19, 16]. For a joint to reach its maximum range of motion, it is necessary to have relaxed antagonist muscles. If there is pain, the tension of the surrounding muscles wouldbe more than usual. So the muscles wouldbe sensitive to stretching and donotlet a full range of motion to be achieved [24]. Exercise therapy leads to a

decrease in pain [23, 22, 19], and this reduction leads tomuscle relaxation and more joint motion.

On the other hand, because the most important benefit of stretching exercises is to improve the rangeof motion of the joints and to increase elasticity ofmuscles, ligaments and other connective tissues, the increase in the range of motion of the neck in different directions, following participation in selected exercise therapy and self-treatment by pamphlet programs, seems to beresulted from including proper stretching exercises in the both training programs.

Based on the results of the present study, it can be concluded that both training programs can developthestrength and range of motion of the neck muscles, although the selected exercise therapy program under the supervision of a trainer,seems to be more beneficialand isrecommended to be included in the rehabilitation programs of the patients with chronic neck pain .

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