ISSN: 2476-5279; International Journal of Musculoskeletal Pain Prevention. 2020; 5(2): 318-328.

Ergonomic and At-work Exercises based Educational Program among Nurses Working in Hospital: a Protocol Design regarding Neck Disorders Prevention

ARTICLE INFO

Article Type
protocol study

Authors

Zeinab Bazvand,[1] *MS*
Sedigheh Sadat Tavafian,[1*] *PhD*
Sahar Boozari,[2] *PhD*
Shahnaz Shahrbanian,[3] *PhD*

How to cite this article

Bazvand Z., Tavafian S. S., Boozari S., Shahrbanian S. Ergonomic and At-work Exercises based Educational Program among Nurses Working in Hospital: a Protocol Design regarding Neck Disorders Prevention. IJMPP. 2020;5(2): 318-328.

[1] Department of Health Education and Health Promotion, Faculty of Medical Sciences, Tarbiat Modares University, Tehran Iran.
[2] Department of Physiotherapy, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran.
[3] Department of Sport Science, Faculty of Humanities, Tarbiat Modares University, Tehran, Iran.

** Correspondence*
Address: Department of Health Education and Health Promotion, Faculty of Medical Sciences, Tarbiat Modares University, Tehran Iran
Tel: +98 21 82884547
Fax : +98 21 82884555
P.O.Box: 14115-331
Email: tavafian@modares.ac.ir

Article History
Received: Apr 14,2020
Accepted: Jun 7, 2020
ePublished: Agu 31, 2020

ABSTRACT

Aim: One of the most important musculoskeletal injuries in health system is neck pain. Therefore the effect of a virtual educational program based on ergonomics principles and at-work exercises regarding prevention of neck pain among nurses working in Imam Khomeini hospital in Pole dokhtar city, Lorestan province of Iran will be studied.

Methods and Instruments: This is a semi-experimental study that will be performed on nurses working in Imam Khomeini Hospital in Pole dokhtar city of Iran. The nurses will be randomly selected and divided into two intervention and control groups. The frequency of MSD as well as nurses' knowledge, attitude and behavior will be assessed using a standard Nordic questionnaire and a researcher-made questionnaire. Principles of ergonomics and at-work exercises will bw practiced just for intervention group. Reassessment will takes place after three months and the results will be compared to the control group through descriptive and analytical analyses.

Keywords: Nurses, Educational Ergonomic/ Exercise Intervention, Principals, Attitude / Behavior Change, Neck Pain.

Introduction

MusculoSkeletal Disorders (MSD) are one of the most common occupational health problems in many countries [1]. Work-related MusculoSkeletal Disorders (WRMSD), are disorders on which the working conditions can effect and cause or aggravate them [2]. One of the common MSD is neck pain which about 67% of people in their lives will experience it [3, 4]. Neck pain in the United States disables 7 million people annually [5]. The prevalence of these disorders in the treatment staff is higher than in other jobs in community [6]. Studies conducted in the United States and China show that one of the most important musculoskeletal injuries in health care personnel is neck pain [7-8]. About ten thousand nurses in the United States suffer from MSD each year [9], job losses and inefficiency [1]. Causes of widespread neck pain among nurses include activities such as moving the patient, sitting and standing for long periods of time, improper physical activity during work such as bending, turning the neck, and doing manual activities Neck pain imposes a great economic burden and can lead to loss of years of work. Moreover, neck pain is prone to becoming chronic and often leads to long-term disability [10]. Furthermore, these disorders are one of the major causes of discomfort and disability in working people which are increasing. [11-13].

Moreover, another major factor that causes these disorders in nurses is factors such as lack of knowledge of ergonomic principles. Due to this limited knowledge, the preparation of an educational program to improve their knowledge about these principles can play a very important role in reducing and

**Corresponding Author:* Department of Health Education and Health Promotion, Faculty of Medical Sciences, Tarbiat Modares University, Tehran Iran. Tel: +982182884547; Fax:+98 2182884555; P.O.Box: 331-14115 ; Email: tavafian@modares.ac.ir

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

preventing these disorders [14-15]. Ergonomic training methods and exercise together play a more effective role in reducing these disorders [16].Therefore, one of the preventive protocols for musculoskeletal pain could be both ergonomic suggestions and at-work excises [17].

Nowadays mobile phone with features like communication compatibility, downloading saving, displaying and controling, temporal and spatial flexibility and decentralization plays an important role in learning, improving learning and self-learning. Currently mobiles are available in most palaces and are user-friendly devices. Therefore, the virtual learning through mobile phone enhances learner satisfaction, encourages them and also enriches their communication activities which will finally increase the learning efficacy [18].

According to studies conducted in Iran, it can be said that in medical science education, the use of virtual methods has been more or less effective than traditional education in different conditions. Furthermore, a positive attitude and high satisfaction among students and faculty members regarding the use of virtual education in most studies have been mentioned [19]. However, the difference between the present study and other studies is reminiscent of the content taught, which is done after the training until the post-test assessment. This work makes the content more effective, which has not been considered in other studies. Therefore, this study aimed to investigate the effect of a virtual education program on ergonomic and at-work exercise principles-based behavior change regarding the prevention of neck pain in nurses working in Imam Hospital, Pol-e-dokhtar, Lorestan province of Iran.

Method and Instrument

This study is a quasi-experimental study that will be done on nurses working in Imam Khomeini Hospital in Pol-e-Dokhtar city of Lorestan province.

In order to determine the sample size, the information on the hospital site was assessed. This assess shows there are approximately 100 nurses working there. Therefore, all 100 nurses (as census) will be studied if eligible. The criteria for entering the study are access to the Internet, mobile phone and the skill of using it. Criteria for excluding from the study are changing the residence, occurrence of any unforeseen events likr job change or job absenteeism that prevented people from participating in the study, history of vertebral surgery, history of spinal fractures, significant neck pain and doctor's prohibition to perform sports movements. After recruiting the eligible nurses based on inclusion/exclusion criteria, they will be divided into two groups control and intervention randomly For data collection Nordic questionnaire and a researcher-made questionnaire will be used. The Nordic Questionnaire is used to determine the prevalence of MSDs. This questionnaire was designed in 1987 by Cornica and colleagues at the Occupational Health Institute in Scandinavia, which is used as a standard questionnaire to collect information on MSDs[20].

This questionnaire consists of two parts: The first part contains general questions such as age, sex, work experience, education level, etc. The second part contains questions about determining the body's complications and discomforts that the respondent should determine their pain or discomfort in 9 areas of their body including neck, shoulders, elbows, wrist / hand, upper back, waist, Pelvis /leg, one or both knees, one or both ankles / and feet during the last year [21].

Second questionnaire will be a questionnaire

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

that is used to determine the knowledge, attitude and behavior of the studied nurses regarding prevention behavior regarding neck pain. This tool consists of 4 sections. First Section is about demographic data and the other three sections assess the nurse's knowledge, attitude and preventive ergonomic based principles due to neck pain.The number of questions will be determined after determining the validity and reliability of the questionnaire. In this study, two qualitative and quantitative methods will be used to evaluate the validity of the questionnaire . Moreover, the retesting method will be used to measure the external reliability and Cronbach's alpha will be used to measure the internal reliability of the questionnaire.

The questions that are in the field of knowledge have four-choice answers, the correct option has a score of one and each of the other three options is given a score of zero. The answer to the questions of the attitude section as a Likert spectrum from fully agreeable has a score of 5 to the complete opposite, which has a score of one.The answers to the questions in the behavior section have 5 options, with the option always giving a score of 5 and the option never giving a score of 1.

Before doing the study, because of coordination with hospital metrics, a plenary sessions with all nurses will be held to explain the purpose, procedure of implementation of the study as well as collaboration and collecting their telephone numbers for virtual education. Then, demographic, Nordic and researcher-made questionnaires will be completed by two groups of experimental and control groups.

At the next stage, according to the data analysis of the initial questionnaires, reference books, literature reviews of educational studies and educational goals of the study, educational content will be prepared as the attached program and will be executed just in the experimental group. Three months after the educational intervention, the post-test questionnaire will be completed in both groups and data will be analyzed by SPSS software version 21 through appropriate tests.

Training will be done in a virtual space through using mobile. In the first part of the training, the content of the training will be given to the experimental group with the aim of sensitizing them and enhancing their awareness. These content include information such as neck pain/disorders prevalence among nurses obtained from previous studies. Furthermore, information about risk factors or causes of MSD and neck pain and also ways to prevent these disorders will be offered. The second section of this virtual educational intervention aims to improve the nurses' beliefs for accepting preventive behavior and that they persuade that they can prevent their neck pain / discomfort with simple self-care methods. This section will be implement through discussion with the nurses in virtual space.In the third part, nurses will be taught the principles of ergonomics and at-work exercises (Appondix) through Short Message Service (SMS) once a week up to 3 months. After 3-month follow up, all nurses in both groups will complete the Nordic and the researcher-made questionnaires.

All data will be entered into the SPSS program and analyzed through Chi square for comparing non-parametric variables, and dependent and independent T-tests for comparing parametric variables.

The ethical considerations of this research are obtaining a license from Ethics committee of Faculty of Medical Sciences of Tarbiat Modares University and Lorestan University of Medical Sciences.

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

All information taken from participants is completely confidential and the questionnaire is unnamed. All participants should sign the informed consent form.

Discussion

We expect that the virtual ergonomics and at-work exercise program would be effective on improving the knowledge, attitude, and behavior of the nurses regarding prevention of neck pain.

Ethics Permission

This study has been approved by Ethic Committee of Tarbiat Modares University.The ethic code for this study is IR.MODARES.REC.1397.251

Acknowledgments

The authors of this study would like to thank Reasech Deputy of Tarbiat Modares University for its financial support .

Authors' Contributions

Bazvand Z, Tavafian SS, Boozari S, Shahrbanian Sh have participated in designing of this study and Bazvand Z will do data collation, data analysis and all stages of study implementation.

Conflicts of Interest

The authors declare that they have no conflict of interest.

Funding/Supports

This study will be supported by Research Deputy of Tarbiat Modares University.

References

1. Bernal D, Campos-Serna J, Tobias A, Vargas-Prada S, Benavides FG, Serra C. Work-related psychosocial risk factors and musculoskeletal disorders in hospital nurses and nursing aides: a systematic review and metaanalysis. Int J Nurs Stud. 2019; 52(2):635-48.
2. Laal F, Madvari RF, Balarak D, Mohammadi M, Dortaj E, Khammar A.Relationship between musculoskeletal disorders and anthropometric indices among bus drivers in Zahedan city. Int J Occup Saf Ergon. 2018; 24(3):431-7.
3. Hush JM, Maher CG, Refshauge KM. Risk factors for neck pain in office workers: A prospective study. BMC Musculoskelet Disord. 2006; 7(1):81-85.
4. Koohpaei A, Khandan M, Vosoughi S, Khammar A, Mobinizade V, Farrokhi M, et al. Industrial workers' postures analysis by a new method named "loading on the upper body assessment" in Iran. Ann Trop Med Public Health. 2017; 10(4):973-7.
5. Douglass AB, Bope ET. Evaluation and treatment of posterior neck pain in family practice. Journal of the American Board of Family Medicine.2004; 17(Suppl): 13-22.
6. Meijsen P, Knibbe HJ. Work-related Musculoskeletal Disorders of perioperative personnel in the Netherlands. AORN J. 2007; 86(2):193-208.
7. Chiou W, Wong M, Lee Y. Epidemiology of low back pain in Chinese nurses. Int J Nurs Stud. 1994; 31(4): 361-8.
8. Polanyi M, Cole D, Beaton D, Chung J, Wells R, Abdolell M. Upper limb work related musculoskeletal disorder army newspaper employs. Am J Ind Med. 1997; 32(4): 620-8.
9. D'Arcy LP, Sasai Y, Stearns SC. Do assistive devices, training, and workload affect injury incidence? Prevention efforts by nursing homes and back injuries among nursing assistants. JAN. 2012; 68(4):836-45.
10. Stephen F. Human, Anthropometry, Ergonomics and Design, Translated byAlireza Chubineh and Mohammad Amin Mo'oudi. 4th ed. Tehran: Center Publication; 1996.
11. Kordani M, Elahi N & Rezai M. Assessment of the relation between neck pain and ergonomic factors in dentists. Jundishapur Scientific Medical Journal. 2007; 6(1): 98-105.
12. Rokni M, Abadi MH, Saremi M, Mir Mohammadi MT. Abundance of Musculoskeletal Disorders and its association with ergonomics And environmental factors in nursing staff. Scientific Journal of Gorgan University of Medical Sciences. 2016; 18(1):128-131.
13. Mohammadian M, Hasheminejad N, Rahimi Moghadam S, Amiri F. The survey of Musculoskeletal Disorders of midwives and its relationship with job stress. J Fundam Ment Health. 2013; 15(3): 171-83
14. SHokati B, YektaKooshali M, Zareiyan A, Akbari Negad SH, Soroush a. The prevalence of Work-Related Musculoskeletal Disorders among X-ray radiographers those working in Radiology Centers of the hospitals affiliated in AJA University of Medical Sciences: A Cross-Sectional Study. Journal of Military Caring Sciences. 2018; 4(3): 198-206.
15. Alexandere NM, Moraes MA, Filho HR, Jorge SA.

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]

[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

Evaluation of a program to reduce back pain in nursing personnel. Revistade Saúde Pública. 2001; 35(4): 356-61.
16. Westgaard R, Winkel J. Ergonomic intervention research for improved musculoskeletal health: A critical review. Int J Ind Ergon. 1997; 20(6):463-500.
17. Tsang SM, So BC, Lau RW, Dai J, Szeto GP. Comparing the effectiveness of integrating ergonomics and motor control to conventional treatment for pain and functional recovery of work-related neck–shoulder pain: A randomized trial. Eur J Pain. 2019; 23(6):1141-52.
18. Naderi F, Ayati M, Zare Bidaki M, Akbari Borang M.Effects of Mobile Learning on Paramedical Students' Academic Achievement and Self-regulationIranian. JME. 2013; 3(3):24-28.
19. Eslami k, kouti l, noori A. Different Methods of Medical Sciences Virtual Education in Iran and Assessment of their Efficacy; a Review Article. Educational Development of Jundishapur. 2016; 7(2):128-13 7.
20. Korinka I, Jonsson B, Kilbom A, et al. Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon. 1987; 25(2):77-87.
21. McAtamney L, Corlett E, Rula N. A survey method for the investigation of work-related upper limb disorders. Appl Ergon. 1993; 24(2):91-9.

Appendix

■ When the body posture while working is at suitable conditions:
Muscle efficiency increases.
Muscle fatigue is prevented.
Job productivity is increased.

Lifting heavy loads can cause pain in the neck.

Severe stress is one of the causes of pain in the neck.

Best table and chair height

■The height of the chair's seat should be approximately equal to the calf's height. As the foot rests on the floor, the thigh and calf are approximately at 90 degrees.

■In case the seat height is not appropriate, adjustments can be made by adjusting the footrest or by using a cushion on the seat.

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

Ergonomic and at-work exercise recommendations for the prevention of Appendixes
The best sitting position

■One of the best sitting positions is to have an angle of about 110 degrees between hip and spine and an angle of about 90 degrees between forearm and arm. Moreover, you should sit almost at the end of the chair, and also to lower the weight on both hips while sitting, and avoid touching the sides.

■The elbows not to be too far from the body.

■The wrist and hand should be in the same line with the forearm.

■In the sitting position, the shoulders should be loose and do not move towards the ears.

■If the monitor is at a very low position and causes the neck to bend forward to read the text, some books can be placed under the monitor.

■One of the ways to sit properly to prevent neck pain is to sit almost at the end of the chair.

■To prevent neck pain do not hunch over the chair or limp in it.

Mistakes that occur while sitting on a chair and behind a desk:

■ The height of the table is very high. In this case, the elbows bent and the angle of the forearm and arm becomes less than 90 degrees due to over-raising of the hands. In this case, the person may also raise his/her shoulder.

■ The height of the armrest is very high. In this case, the elbow is bent and the forearm and arm angle becomes less than 90 degrees due to over-raising of the hands. In this case, the person may also raise their shoulders.

■ The seat is very long and the person sits on the edge of the chair.

■The best position is to sit almost at the end of the chair, and also to lower the weight on both hips while sitting, and avoid touching the sides.

■ The armrest is designed so that the arm rests against the edge of the desk and the person's leg does not go under the table. The distance between the chair and the table must be in a way that forearm rests on the table or be placed on the chair armrest. At any case it's necessary that the elbow be supported and the arm and forearm have an angle about 90 degrees.

■ If the chair is too high, we will crumple while writing or typing on the work surface and the neck will be in an inappropriate position.

■ If the chair is too short, the forearm may get close to the arm while writing or typing the forearm, which can cause shoulder and neck pain. In such case the knees'and the spine's posture would not be appropriate.

■ Sitting in a lounge or humpposition.

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

How to stand behind a desk

■If the height of the table is short, you can raise the table height by placing a wooden surface on it.

■One of the correct ways of standing behind the desk is to put your feet under the table and do the work with a straight spine.

■Put your feet under the table and get the work done with the spinal column straight.

■If the work environment is long:

When the desk and chair are high, it is necessary to use the footrest.

For long-period standing either balance the weight equally on both legs or preferably place one foot on a stool or on something higher.

Sleeping and pillow height

■Getting enough sleep and being in the right state is one of the best ways to prevent neck pain.

■Another point about sleeping at night to prevent neck pain is not to sleep on your chest.

■One of the points about sleeping at night to prevent neck pain is to put the pillow in a way it maintains the normal alignment of the spine and at the same time fills the gap between the neck and the shoulder.

Lift the load from the upper floors of the shelves

■When performing tasks such as taking medicine off the medicine cabinet at a higher position according to the shoulders, be sure to use a stool or so.

Blood sampling

■While drawing blood from veins we should not bend the head, neck or waist to the patient. The best position is to sit on a chair next to the patient.

■While getting a shot and having no access to a chair and being forced to stand, it is better to bend your knees slightly to reduce your spine being bent.

When you have to bend my neck while working, it is better to reduce the distance between the work surface and my neck to avoid over-bending my neck as much as possible.

Avoid carrying heavy loads or light loads unilaterally that cause the neck and back to bend sideways.

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]

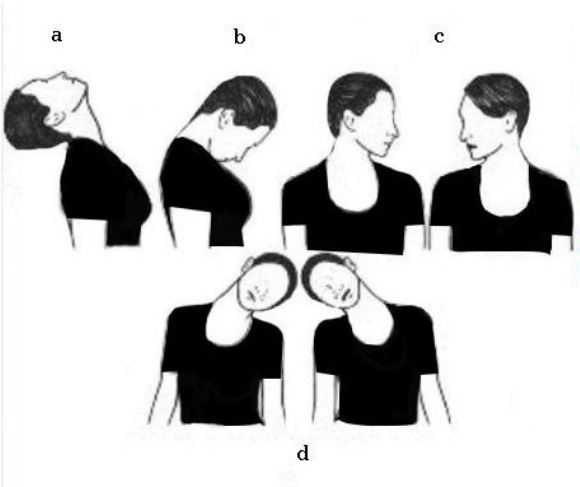
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

Do not put your hands in your pockets for long walks to keep your hands moving freely, which is the opposite of the legs, reducing energy consumption in the body.

When you are forced to bend you neck over while working, it is better to move the head slowly from time to time in different directions.

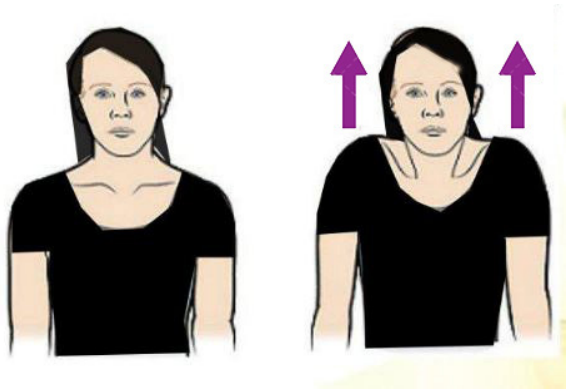
To prevent neck pain, try not to sit for more than 20 minutes, get up and sit again after a few stretching movements.

Neck problems can be largely prevented despite poor working conditions by doing simple exercise during work.
Simple exercise



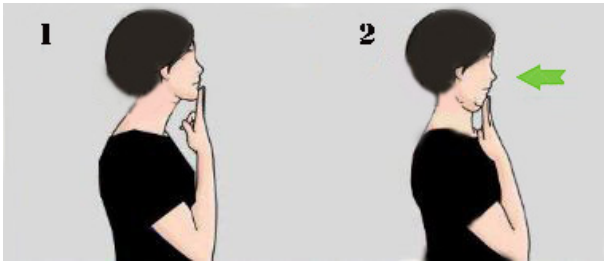
•Do this exercise sitting or standing
•If you're in a sitting position, try to keep the spine straight and avoid leaning to the chair.
•Perform the exercises gently without feeling any pain in the neck as following:
a) Slide the chin toward the ceiling and bend your head backward. Then slowly restore it to its normal position.
b) Lower the chin to the chest and bend the head forward. Then slowly return it to your normal position.
c) Bend your head slowly to the right and left. Be careful not to rotate the face up and down during this movement.
d) Turn your head slowly to the right and left. Be careful not to rotate the face up and down during this movement

Perform each movement gently five to ten times three times a day.



• Raise your shoulders up and then down after a short pause.

Hold every move between five to seven seconds. Ten times, Three times a day



• To perform this exercise you need to either stand or sit on a chair with your spinal column straight and slowly get double chin.
• Be careful not to bend the head and neck for double chin, but as the head is straight, push the chin backwards slowly.
• After a short pause, return the head and neck back to the normal position.
• Make each move for five seconds, ten times,

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

three times a day.

• Be sitting or standing
• Like what you can see in the picture, place one of your hands behind your neck gently move the head away from the side of the hand placed on your back.
• Then look at the shoulder as shown in the picture and bring your head back to normal position. Repeat the move for the opposite side as well.
• Hold each stretch for up to five seconds and return the head back to its previous position and then, repeat the move to the opposite side.
• Wait a short time between each stretches and don't perform the move too fast.
• You can slowly twist your shoulders backwards after each stretch.
• Two or three times for each side, three times a day

The best situation is to keep any stretch up to thirty seconds.
Exercise each stroke 2-3 times and three times per day.
Try to increase the stretching time gradually.

• Be in the sitting or standing position and place your hand on your back as you can see in the picture.
• Gently push the head away from the hand placed in the back.
• Then look at the shoulder as shown in the picture.
• Slowly return the head back to the normal condition.
• Repeat the move for the opposite side as well.
• Hold the stretching position for five seconds and slowly return the head to the former position
• Then do the opposite.
• Wait shortly between the two stretches and don't do the move too fast.

After each stretch you can gently twist your shoulders backwards and repeat each stretch two to three times for every side, three times a day.
Try to increase the stretching time gradually.
It is better to keep any stretch condition up to thirty seconds.

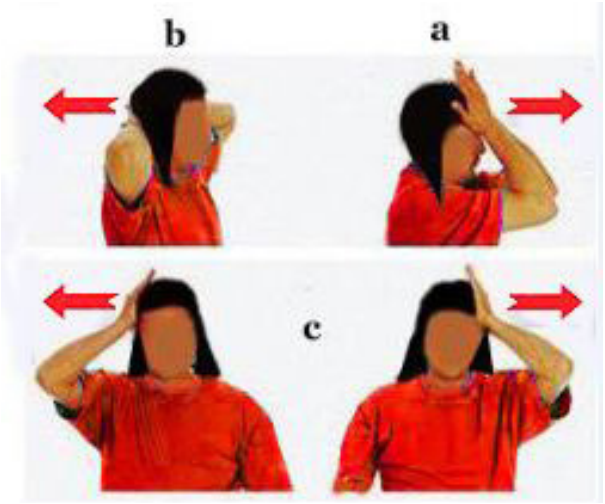
[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

• Getdouble chin, then slowly bend forward with the help of your hands and without double chin being removed.
• With one hand, you can keep yourdouble chin
• Hold the stretching position for five seconds and return the head slowly to the first position.

Perform the movement three times a day, ten times

• Hold the shape of your hands so that the elbow and arm angle, and the arm and body are approximately
• Stand on the wall
• One foot closer to the wall
• Slowly push yourself against the wall to feel a slight pull on the front and front of your chest
• Then slowly move away from the wall
• Hold up to 5 seconds and slowly return to the original

Exercise each stretch 2 to 3 times a day
Try to increase the stretching time gradually
When you are able to increase the stretching time to 30, do this stretch 2 times each time and perform the movement twice a day



• You can perform this exercise in sitting or standing position
• The important point is that the head and the neck must be in their normal position and not to be bent or turned to any sides.
• For the sake of that. it is better to perform the very exercise in front of the mirror with your face being straight.
• Hold each movement between six to ten seconds, for ten times and three times a day.
• The amount of pressure you apply must be less than the maximum power.

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]

a) Put your palms on the forehead and press the forehead to the hands as you want to bend the head and neck forwards. Be careful not to move the head and the neck really, in this exercise.
B) Put your palms behind your head and press your head into your hands as you want to bend the head and the neck backwards. Be careful not to move the head and neck really, in this exercise.
c) Put the right palm the right side of your head and press the head to your hand, as you want to bend the head to the right. Be careful not to move the head and neck really, in this exercise.

Repeat the move to the opposite side as well.

• Be standing
• Like what you see Slide your hands back and hook them together then bring your two shoulders closer form back.

Hold every move between five to seven seconds
Perform the movement three times a day, ten times.

[Downloaded from ijmpp.modares.ac.ir on 2024-04-27]
[DOR: 20.1001.1.24765279.2020.5.2.2.9]
[DOI: 10.52547/ijmpp.5.2.318]