Clinical Trial Protocol
Iranian Registry of Clinical Trials

22 Nov 2026

Comparison of the effects of (Chest-up/Sternal Lift) exercises and Routine exercises on pain, Electromyographic activity and the postural alignment of the head, neck, and thorax in static position and functional task in individuals with Neck Pain Associated with Forward Head Posture

Protocol summary

Study aim

This study aims to compare the effects of Chest-up / Sternal Lift exercises and routine exercises on pain intensity, electromyographic muscle activity, and postural alignment of the head–neck region and thorax in static posture and during functional activities in individuals with neck pain accompanied by forward head posture.

Design

Randomized clinical trial, single-blind (outcome assessment), parallel-group, Phase II, with two active intervention groups on 60 patients. Randomization was performed using the concealed envelope method.

Settings and conduct

This clinical trial is conducted in the Physiotherapy Laboratory of Tarbiat Modares University. After baseline assessment, participants are randomly allocated to two active intervention groups and receive therapeutic exercises under therapist supervision. Outcome assessment is performed by an independent assessor blinded to group allocation.

Participants/Inclusion and exclusion criteria

Inclusion criteria: Adult individuals with non-specific neck pain accompanied by forward head posture, able to perform therapeutic exercises, and providing informed consent. Exclusion criteria: history of cervical spine surgery, acute neck trauma or injury, known neurological or musculoskeletal disorders, systemic conditions affecting movement, specific neck pain, or concurrent neck-related treatments.

Intervention groups

Participants are allocated to Chest-up / Sternal Lift and routine neck exercise groups. Interventions are delivered for 10 sessions (3 sessions per week). In both groups, infrared thermotherapy and TENS are applied before exercises.

Main outcome variables

Neck pain intensity; electromyographic activity of selected neck and shoulder muscles; head and neck postural alignment (CVA) in static posture and during functional activities

General information

Reason for update

Acronym

IRCT registration information

IRCT registration number: **IRCT20250819066911N1**
Registration date: **2026-02-15, 1404/11/26**
Registration timing: **prospective**

Last update: **2026-02-15, 1404/11/26**
Update count: **0**

Registration date

2026-02-15, 1404/11/26

Registrant information

Name

soroosh mostafaei

Name of organization / entity

The University of Tarbiat Modares

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Recruitment status

Recruitment complete

Funding source

Expected recruitment start date

2026-02-23, 1404/12/04

Expected recruitment end date

2026-08-23, 1405/06/01

Actual recruitment start date

empty

Actual recruitment end date

empty

Trial completion date

empty

Scientific title

Comparison of the effects of (Chest-up/Sternal Lift) exercises and Routine exercises on pain, Electromyographic activity and the postural alignment of the head, neck, and thorax in static position and functional task in individuals with Neck Pain Associated with Forward Head Posture

Public title

Comparison of Specific Corrective Exercises and Routine Neck Exercises on Pain and Posture in Individuals with Forward Head Posture

Purpose

Treatment

Inclusion/Exclusion criteria

Inclusion criteria:

Presence of neck pain in the posterior cervical region with moderate pain intensity (VAS score between 35 and 74 Craniovertebral Angle less than 53 degrees Male participants aged between 20 and 50 years

Exclusion criteria:

Presence of cervical radiculopathy or discopathy (based on radiographic or MRI findings) History of any surgery in the neck region Presence of thoracic kyphosis greater than 45 degrees (thoracic hyperkyphosis) Radiologic signs of severe osteoarthritis Presence of any inflammatory disease History of malignancy Congenital spinal deformities Individuals with BMI > 30 kg/m² Previous injury to the neck or upper back area involving T1–T6 levels Professional training or having received physiotherapy due to neck pain within the past six months before examination Other concurrent musculoskeletal disorders or neurological symptoms

Age

From **20 years** old to **50 years** old

Gender

Male

Phase

2

Groups that have been masked

- Outcome assessor
- Data analyser

Sample size

Target sample size: **60**

Randomization (investigator's opinion)

Randomized

Randomization description

In this study, participants will be randomly allocated to the intervention groups using a simple randomization procedure. After screening for inclusion and exclusion criteria, each eligible participant will be assigned a random number generated by the RAND function in Microsoft Excel. Based on the randomization list, participants will be allocated either to Exercise Group A or Exercise Group B. The randomization sequence will be prepared by an independent researcher who will not be involved in data collection to minimize selection bias. Group assignments will be placed in sealed, opaque, and sequentially numbered envelopes, each containing the group allocation card. Each envelope will be opened only after participant enrollment and in the presence of the intervention supervisor. The unit of randomization will be individual participants, with no stratification or block randomization applied. Allocation concealment will be maintained through the use of sealed and numbered envelopes to ensure blinding of the assessor until the intervention phase begins.

Blinding (investigator's opinion)

Single blinded

Blinding description

This study is designed as a single-blind randomized controlled trial. Outcome assessments are conducted by an independent assessor (a biomechanical laboratory engineer) who is blinded to group allocation to minimize measurement bias in assessing dependent variables, including craniovertebral angle (CVA), cervical muscle activity measured by surface electromyography (EMG), muscle strength, and the Neck Disability Index (NDI). Participants are aware of the type of intervention they receive, as knowledge of exercise content is essential for safety considerations and the provision of informed consent. To minimize information exchange between groups, intervention sessions are scheduled at different times. Although the principal investigator is aware of group allocation, all collected data are coded before statistical analysis and provided to an independent data analyst who is blinded to group allocation. Statistical analyses are performed using SPSS software to further reduce the risk of bias. Accordingly, this study is classified as a single-blind randomized controlled trial in which both the outcome assessor and the data analyst are blinded, while participants, therapist, and the principal investigator are not blinded due to the nature of exercise therapy interventions.

Placebo

Not used

Assignment

Parallel

Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee

Name of ethics committee

Ethics committee of Tarbiat Modares University

Street address

Ethics Committee, Prefabricated Building, School of

Medicine, Tarbiat Modares University, Nasr Bridge, Jalal Al-e-Ahmad Street, Tehran

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Postal code
۱۴۱۱۷۱۳۱۱۶

Approval date
2025-10-25, 1404/08/03

Ethics committee reference number
IR.MODARES.REC.1404.124

Health conditions studied

1

Description of health condition studied
Neck pain

ICD-10 code
M54.2

ICD-10 code description
Cervicalgia

Primary outcomes

1

Description
The craniovertebral angle as an indicator of head posture, representing the anterior displacement of the head relative to the cervical spine. This angle is defined by the intersection of a horizontal line passing through the spinous process of the seventh cervical vertebra and a line connecting this point to the tragus of the ear. Changes in the craniovertebral angle reflect improvement or worsening of forward head posture and this variable is considered the primary outcome for determining the effect of the exercise interventions and for sample size calculation.

Timepoint
Measurement of the craniovertebral angle is performed at two time points: at baseline before the initiation of the intervention and at the end of the intervention period after completion of the exercise sessions.

Method of measurement
The craniovertebral angle is measured using digital photography in a natural standing posture, a seated position, and during a functional typing task. The captured images are analyzed using angle analysis software. The spinous process of the seventh cervical vertebra and the tragus of the ear are identified as anatomical landmarks, and the angle between a horizontal line passing through the spinous process of the seventh cervical vertebra and a line connecting this point to the tragus of the ear is calculated.

2

Description
Neck pain intensity is considered as an indicator of the participants' subjective experience of pain. This variable reflects the perceived level of pain in the neck region and is used to evaluate the effect of the exercise interventions on changes in pain intensity.

Timepoint
Neck pain intensity is measured at two time points: at baseline before the initiation of the intervention and at the end of the intervention period after completion of the treatment sessions.

Method of measurement
Neck pain intensity is measured using the visual analogue scale. This scale consists of a 100-millimeter horizontal line, with one end representing no pain and the other end representing the worst imaginable pain. Participants are asked to indicate their neck pain intensity on this line at the time of assessment, and the pain score is recorded in millimeters.

Secondary outcomes

1

Description
Chest expansion is considered a functional indicator of thoracic mobility and respiratory–musculoskeletal coordination. This variable represents the change in chest circumference between maximal inspiration and maximal expiration and is used to evaluate the effect of exercise interventions on improving thoracic mobility in individuals with neck pain accompanied by forward head posture.

Timepoint
Chest expansion is measured at two time points: at baseline before the initiation of the intervention and at the end of the intervention period after completion of the exercise sessions.

Method of measurement
Chest expansion is measured using a fabric measuring tape at two different levels of the thorax.The anatomical landmarks for the upper chest level include the third intercostal space, the midclavicular line, and the spinous process of the fifth thoracic vertebra.The anatomical landmarks for the lower chest level include the xiphoid process and the spinous process of the tenth thoracic vertebra.Chest circumference at each level is recorded following maximal inspiration and maximal expiration, which are taught to the participants prior to measurement. Measurements are performed in the standing position with the arms positioned alongside the body. The physiotherapist places the zero mark of the measuring tape over the corresponding vertebral landmarks, and the fabric tape is held without causing skin folds or deformation, maintaining a consistent distance using the index finger between the participant's body and the tape. The difference between inspiratory and expiratory measurements is calculated as the chest expansion value at each level.

2

Description
The Neck Disability Index is considered as a secondary outcome variable in this study to assess the level of

disability associated with neck pain in patients with neck pain. This index evaluates the impact of neck pain on the performance of daily activities.

Timepoint

The Neck Disability Index is measured at two time points: at baseline before the initiation of the intervention and at the end of the intervention period after completion of the treatment sessions.

Method of measurement

Neck disability is assessed using the Persian version of the Neck Disability Index questionnaire. This questionnaire consists of ten sections, each scored from zero to five, where a score of zero indicates no disability and a score of five represents maximum disability. According to the study by Mousavi and colleagues, the Persian version of this questionnaire has demonstrated high validity and excellent reliability in individuals with neck pain.

3

Description

The craniohorizontal angle is considered as a secondary outcome variable in this study to evaluate sagittal head posture in individuals with non-specific neck pain associated with forward head posture. This angle reflects the orientation of the head relative to the horizontal plane and is used as a complementary indicator of postural changes of the head.

Timepoint

The craniohorizontal angle is measured at two time points: at baseline before the initiation of the intervention and at the end of the intervention period after completion of the exercise sessions. Measurements are performed in standing posture, seated posture, and during a functional typing task.

Method of measurement

The craniohorizontal angle is measured using sagittal plane digital photography and image analysis with video analysis software. A fourteen-millimeter marker is placed on the tragus of the ear and another marker on the lateral canthus of the eye. The craniohorizontal angle is defined as the angle between a line connecting the tragus of the ear to the lateral canthus of the eye and a horizontal line passing through the tragus.Images are captured using an iPhone 12 Pro Max mounted on a tripod at a distance of three meters from the participant, with the camera height aligned with the level of the seventh cervical vertebra. Photographs are taken from the dominant side of each participant. Immediately after image acquisition in standing posture, seated posture, and during the functional task, the files are transferred to a laptop for analysis. The angle is recorded in degrees.

4

Description

Thoracic kyphosis angle is considered as a secondary outcome in this study to evaluate sagittal curvature of the thoracic spine in individuals with non-specific neck pain associated with forward head posture. This variable is used to assess concurrent thoracic postural changes following corrective interventions.

Timepoint

Thoracic kyphosis angle is measured at two time points: at baseline before initiation of the intervention and at the end of the intervention period after completion of the exercise sessions. Measurements are performed in a relaxed standing posture.

Method of measurement

Thoracic kyphosis angle is measured using a flexible ruler. The flexible ruler is a moldable lead strip with a plastic coating and an approximate length of sixty centimeters. The tip of the ruler is placed on the spinous process of the seventh cervical vertebra and molded along the thoracic curvature to the level of the spinous process of the twelfth thoracic vertebra.After marking the positions of the seventh cervical and twelfth thoracic vertebrae, the ruler is removed and placed on millimeter paper. The curvature from the seventh cervical to the twelfth thoracic vertebra is traced onto the paper. A straight line connecting these two points is drawn. The maximum perpendicular distance between the traced curve and the straight line is defined as the curve height. The distance from this point to the twelfth thoracic vertebra is defined as the middle length, and the total length is defined as the straight-line distance between the two vertebrae. These values are entered into the corresponding calculation formula using spreadsheet software, and the thoracic kyphosis angle is calculated in degrees.

5

Description

Surface electromyographic activity of muscles is considered as a secondary outcome in this study to evaluate muscle activation patterns in individuals with non-specific neck pain associated with forward head posture. This variable is used to assess changes in superficial muscle activity following corrective exercise interventions.

Timepoint

Electromyographic activity is recorded at two time points: at baseline before initiation of the intervention and at the end of the intervention period after completion of the exercise sessions.

Method of measurement

Surface electromyographic activity is recorded using a sixteen-channel electromyography system manufactured in Switzerland. Bilateral recordings are obtained from the pectoralis major, sternocleidomastoid, cervical extensor muscles at the level of the fourth cervical vertebra, and thoracic erector spinae muscles at the level of the fourth thoracic vertebra. Prior to data collection, skin preparation, including showering before laboratory attendance, hair removal if necessary, and cleaning with alcohol is performed to reduce skin impedance to less than ten megaohms. Signals are recorded with a sampling frequency of one thousand hertz, band-pass filtered between twenty and four hundred hertz, using a one-hundred-millisecond time window. Electrode placement follows the SENIAM protocol and previous literature. Muscle activity is recorded during static posture and during a functional typing task. During the functional task, data are collected between minutes

eleven and fourteen. Outcome parameters include root mean square and peak root mean square values. To normalize electromyographic data, maximum voluntary isometric contractions are obtained manually for each muscle using a hand-held dynamometer. Each contraction is performed three times for five seconds, and the highest value is used for normalization.

6

Description

The thoracic cage vertical position relative to the ground is considered as secondary outcome in this study. This variable is used to evaluate changes in the spatial position of the thoracic cage and to assess the effect of the intervention on postural alignment in individuals with non-specific neck pain associated with forward head posture. It reflects alterations in thoracic cage height under static and functional conditions.

Timepoint

Thoracic cage vertical position is measured at two time points:before the intervention and at the end of the intervention period

Method of measurement

To measure thoracic cage vertical position, markers are placed on the jugular suprasternal notch, the xiphoid process of the sternum, and the anterior-inferior aspect of the bilateral tenth ribs. Photographs are then taken from participants in standing and sitting positions as well as during a functional typing task, using a sagittal view. Images are captured using an iPhone 12 Pro Max and analyzed with Kinovea software. The vertical height of each marker relative to the ground is calculated and recorded.

Intervention groups

1

Description

Intervention group: Intervention group 1 (Chest-up / Sternal lift exercises):After baseline assessments, participants are randomly allocated to two exercise groups using the sealed envelope method. Participants in this group receive specific Chest-up / Sternal lift exercises. Supervised in-person treatment sessions are conducted three times per week. In addition, participants perform the exercises at home twice daily, and correct performance is monitored by the researcher via video calls.Both groups receive routine physiotherapy prior to exercise, including superficial thermotherapy using infrared radiation and transcutaneous electrical nerve stimulation. In the Chest-up / Sternal lift group, all exercises are performed while maintaining the chin-tuck position. Exercise intensity is adjusted based on the Borg Rating of Perceived Exertion scale within the range of 12 to 14.The exercise program consists of four exercises: concentric Chest-up exercise, eccentric Chest-up exercise, concentric lifting of the sternum and ribs using elastic resistance, and thoracic spine extension on a foam roller combined with lifting of the chest and upper limbs. Deep inhalation is emphasized during chest elevation in all exercises. Each exercise is initially performed for 10 repetitions, with progression of five additional repetitions every three sessions according to the overload principle.The treatment period consists of ten sessions, three times per week over consecutive weeks.

Category

Rehabilitation

2

Description

Intervention group: Intervention group 2 (Routine neck exercises):After baseline assessment and random allocation using the sealed envelope method, participants in this group receive routine neck exercise therapy. Supervised sessions are conducted three times per week, and participants also perform the exercises at home twice daily, with correct execution monitored via video calls by the researcher.Similar to the first group, participants receive routine physiotherapy before exercises, including infrared radiation and transcutaneous electrical nerve stimulation. The exercise program includes four exercises: deep neck flexor strengthening using the chin-tuck maneuver in the supine position, resisted isometric neck exercises in flexion, extension, and right and left lateral bending, horizontal scapular abduction in the prone position, and bilateral shoulder extension with scapular retraction (low row).Each exercise is initially performed for 10 repetitions, with progression of five additional repetitions every three sessions according to the overload principle. The treatment period consists of ten sessions, three times per week over consecutive weeks.

Category

Rehabilitation

Recruitment centers

1

Recruitment center

Name of recruitment center

Tarbiat Modares University

Full name of responsible person

Giti Torkaman

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Sponsors / Funding sources

1

Sponsor
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Grant name
Grant code / Reference number
Is the source of funding the same sponsor organization/entity?
Yes
Title of funding source
The University of Tarbiat Modares
Proportion provided by this source
100
Public or private sector
Public
Domestic or foreign origin
Domestic
Category of foreign source of funding
empty
Country of origin
Type of organization providing the funding
Academic

Person responsible for general inquiries

Contact
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Full name of responsible person
Soroosh Mostafaei
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Sharing plan

Deidentified Individual Participant Data Set (IPD)
Yes - There is a plan to make this available

Study Protocol
Yes - There is a plan to make this available

Statistical Analysis Plan
Yes - There is a plan to make this available

Informed Consent Form
No - There is not a plan to make this available

Clinical Study Report
Not applicable

Analytic Code
No - There is not a plan to make this available

Data Dictionary
Yes - There is a plan to make this available

Title and more details about the data/document
De-identified individual participant data, study protocol, statistical analysis plan, and data dictionary The individual participant data of this study include baseline demographic information, primary and secondary outcome variables, and measurement results. All data will be shared after complete removal of personal identifiers and will be provided in a fully de-identified format. Complete raw datasets for all primary and secondary outcomes will be available for sharing. In addition, the final study protocol, the pre-specified statistical analysis plan, and the data dictionary will be shared to facilitate proper understanding and reuse of the data.

When the data will become available and for how long
Access to the data and related documents will begin 6 months after publication of the final study results and will remain available for 5 years following the publication date.

To whom data/document is available
The data and study documents will be made available to researchers affiliated with academic, research, and scientific institutions. Researchers outside academic settings may also be granted access upon submission of a scientifically valid request.

Under which criteria data/document could be used
The data will be available exclusively for scientific research purposes, including secondary analyses, systematic reviews, meta-analyses, and comparative studies. Commercial use of the data is not permitted. Applicants must submit a brief research proposal describing the study objectives, planned statistical analyses, and a commitment to maintaining data confidentiality. Any use of the data must appropriately acknowledge the original study.

From where data/document is obtainable
Requests for access to the data and study documents should be submitted through direct correspondence with the principal investigator. Primary contact method: email communication with the principal investigator. If no response is received, requests may be followed up through the registered postal address of the study.

What processes are involved for a request to access data/document
After submission, the applicant’s research proposal will be reviewed by the principal investigator for scientific and ethical appropriateness. Upon approval, the de-identified data will be provided within 4 weeks. In case of rejection, the reasons will be communicated to the applicant in writing.

Comments
All shared data will be fully de-identified, and data sharing will be conducted in accordance with research ethics principles and national data protection regulations.