RESEARCH PROTOCOL

EFFECTIVENESS OF A HOME-BASED PROGRAMME WITH DIAPHRAGMATIC BREATHING RE-EDUCATION AND A VOLUMETRIC INCENTIVE SPIROMETER COMBINED WITH MUSCLE STRENGTHENING IN PATIENTS WITH UPPER CROSSED SYNDROME: A RANDOMISED CONTROLLED TRIAL WITH REMOTE REINFORCEMENT

Study protocol

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Field: Physiotherapy | Home-based programme with remote monitoring

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ABSTRACT

Background: Upper Crossed Syndrome (UCS) is a neuromuscular imbalance of the upper quadrant characterised by hyperactivity and shortening of the pectorals, upper trapezius, levator scapulae and sternocleidomastoid, alongside inhibition of the deep cervical flexors, lower trapezius, rhomboids and serratus anterior. Prevalence ranges from 11% to 60% across populations. Clinical consequences include neck and shoulder pain, tension headache, scapular dyskinesis and impaired ventilatory mechanics. Home-based programmes without supervision show lower adherence than supervised ones, and the role of diaphragmatic breathing re-education as a specific therapeutic component in UCS has been scarcely evaluated.

Objective: To compare the effectiveness of a 12-week home-based programme combining muscle strengthening and diaphragmatic breathing re-education with a volumetric incentive spirometer and active remote reinforcement (Experimental Group, EG) versus an identical programme without the spirometer and with minimal follow-up (Control Group, CG) on postural angles in adults with UCS.

Methods: Two-arm parallel, assessor-blinded randomised controlled trial. Ninety-six adults with confirmed UCS (craniovertebral angle CVA < 52°, rounded shoulder posture RSP > 52°, thoracic kyphosis > 42°) will be randomly allocated (48 per arm). Both groups perform three 20-minute sessions per week for 12 weeks: costal breathing re-education and targeted muscle strengthening and stretching. The EG additionally uses a Coach2 flow-volume incentive spirometer (4000 mL, Smiths Medical) as visual biofeedback and receives biweekly physiotherapist video calls plus asynchronous educational material. Primary outcome: CVA by lateral photogrammetry at weeks 0, 4, 8 and 12. Secondary outcomes: RSP, thoracic kyphosis (bubble and smartphone inclinometer), pain (VAS), cervical disability (NDI), shoulder pain and disability (SPADI), adherence, and pulmonary function by spirometry (FVC, FEV_1/FVC, MVV as % predicted) at weeks 0 and 12.

Statistical Analysis: Mixed repeated-measures ANOVA (group × time, four assessment points); partial η^2 and Cohen's d as effect-size estimates; intention-to-treat analysis with last-observation-carried-forward imputation for missing data.

Relevance: This trial will generate evidence on the added value of incentive spirometry and structured remote reinforcement in home-based corrective physiotherapy for UCS, a prevalent but under-treated condition in working-age adults.

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1. INTRODUCTION

Upper Crossed Syndrome (UCS) is a neuromuscular imbalance pattern of the upper quadrant first described by Vladimir Janda in 1994.[1] According to this model, hyperactivity and shortening of the pectoralis major and minor, upper trapezius, levator scapulae and sternocleidomastoid (SCM) coexist with inhibition and relative weakness of the deep cervical flexors, lower trapezius, rhomboids and serratus anterior.[1] This reciprocal imbalance produces the characteristic postural alterations of the syndrome: forward head posture (FHP), rounded shoulder posture (RSP) and thoracic hyperkyphosis.

The prevalence of UCS varies widely depending on the population studied and the diagnostic criteria applied, ranging from 11% to 60% across different groups,[2] reflecting both the heterogeneity of operational definitions and the high susceptibility of certain occupational profiles. Recent systematic reviews confirm that UCS is particularly prevalent among office workers, university students, professionals who stand for prolonged periods and athletes in anterior-plane-dominant sports.[2,3] In university populations, some studies report FHP prevalence above 68%, directly related to increased screen time and sedentary habits driven by the digitalisation of work and study.[4]

The clinical consequences of UCS are multiple and interdependent. In the musculoskeletal domain, the syndrome is associated with cervical, dorsal and shoulder pain, cervicogenic tension headache, scapular dyskinesis, altered scapulohumeral rhythm, subacromial impingement syndrome and accelerated articular degeneration of the cervicothoracic spine.[2,3,4] Beyond the musculoskeletal sphere, UCS also compromises ventilatory function: increased thoracic kyphosis reduces rib-cage mobility and impairs respiratory mechanics,[4] while FHP compresses the phrenic nerve and causes chronic activation of accessory respiratory muscles —SCM, scalenes and pectoralis minor— progressively reducing diaphragmatic contribution to the breathing pattern.[5] A significant positive correlation has been documented between CVA and vital capacity, FVC and FEV_1, as well as a negative correlation between CVA and SCM electromyographic activity,[5] highlighting the close bidirectional relationship between cervical posture and respiratory function in this population.

Physiotherapy has proven effective in the conservative management of UCS. Several randomised controlled trials have demonstrated significant improvements in postural angles, pain and function following structured therapeutic exercise programmes combining stretching of shortened muscles with strengthening of inhibited muscles,[6,7,8,9,10] following the principles of the National Academy of Sports Medicine (NASM) corrective model: inhibit, lengthen, activate and integrate.[4,8] The most recent systematic reviews and meta-analyses confirm that multicomponent exercise programmes —addressing forward head posture, rounded shoulders and thoracic hyperkyphosis simultaneously— produce the largest effect sizes on postural angles ($p < 0.001$), and that their effects are maintained after detraining periods of up to four weeks.[2,3,10]

Despite the evidence for respiratory consequences of UCS, ventilatory muscle re-education has been poorly integrated into rehabilitation programmes for this syndrome. The randomised controlled trial by Jeong and Lee[5] was the first to incorporate diaphragmatic breathing re-education (DBR) into a shoulder-scapular stabilisation programme for men with UCS. Their results showed that combining DBR with scapular stabilisation exercises produced superior improvements in CVA and pressure pain threshold compared with stabilisation exercises alone, underscoring the added value of the respiratory component in UCS treatment. Consistent with these findings, Yan and Kim[11] recently demonstrated that incorporating breathing training into scapular stabilisation exercises in adults with UCS

produced significant improvements in pressure pain threshold, respiratory function (spirometry) and lower costal expansion, establishing respiratory re-education as a first-order therapeutic component in this syndrome. Building on this evidence, the present protocol introduces the volumetric incentive spirometer as a visual biofeedback tool to quantify and progressively increase inspiratory volume without SCM activation, representing a clinical and methodological novelty not yet explored in the UCS context.

Since home-based programmes without supervision show lower adherence rates than supervised ones,[12] remote reinforcement through periodic video calls and asynchronous audiovisual material emerges as a promising strategy to maintain motivation and technical quality of home exercise at a lower cost than continuous face-to-face care. Yaghoubitajani et al.[12] demonstrated that online supervision was equivalent to in-person supervision in terms of postural and pain improvements in office workers with UCS, and superior to no supervision. Jeong and Lee[5] used telerehabilitation to add clinical monitoring to a DBR programme for UCS, demonstrating the feasibility and efficacy of structured remote care in this condition. The present study extends these findings by incorporating an asynchronous reinforcement component —weekly instructional videos and messaging feedback— that has not been systematically evaluated in the UCS literature.

The present protocol describes a two-arm parallel randomised controlled trial with assessor blinding, designed to compare the effectiveness of a 12-week home-based programme integrating muscle strengthening and diaphragmatic breathing re-education with a volumetric incentive spirometer plus active remote reinforcement (Experimental Group, EG) versus a programme combining muscle strengthening and diaphragmatic breathing re-education without the incentive spirometer and with minimal adherence monitoring (Control Group, CG). The primary outcome is the craniovertebral angle (CVA), a validated indicator of forward head posture.[4,5,10]

2. OBJECTIVES

2.1 Primary objective

To evaluate the effectiveness of a 12-week home-based programme combining muscle strengthening and diaphragmatic breathing re-education with a volumetric incentive spirometer plus active remote reinforcement on postural angles in patients with Upper Crossed Syndrome, compared with an equivalent programme of muscle strengthening and diaphragmatic breathing re-education without the spirometer and with minimal adherence monitoring.

2.2 Secondary objectives

1. To compare changes in CVA, rounded shoulder posture angle (RSP) and thoracic kyphosis angle (inclinometry) between both groups at weeks 4, 8 and 12.
2. To compare changes in pain (VAS), cervical functional disability (NDI) and shoulder pain and disability (SPADI) between the EG and CG.
3. To evaluate and compare adherence to the home programme in both groups during the 12-week intervention.
4. To determine the inter-rater reliability of the photographic measurement protocol with Kinovea for CVA and RSP.

5. To explore whether active remote reinforcement is associated with greater adherence and better clinical outcomes compared with minimal monitoring.

3. METHODOLOGY

3.1 Study design

Randomised controlled trial (RCT) with two parallel groups, permuted-block randomisation (blocks of 4 and 6), assessor blinding (single blind) and intention-to-treat as the primary analysis. The assessor responsible for photographic measurements and Kinovea analysis will be unaware of group allocation throughout the study period. Participants will be informed that two different programmes exist, but will not know the content of the group to which they do not belong. The study will be registered on ClinicalTrials.gov or ISRCTN prior to the enrolment of the first participant and reported following the CONSORT statement.

The intervention will consist of two conditions:

- Experimental Group (EG): home-based programme of muscle strengthening + diaphragmatic breathing re-education with volumetric incentive spirometer + active remote reinforcement (biweekly video call + asynchronous audiovisual material + messaging feedback). Duration: 3 sessions/week × 12 weeks (20 min/session). Based on the validated exercise protocols of Jeong and Lee[5] and Seidi et al.[10]
- Control Group (CG): home-based programme of muscle strengthening + diaphragmatic breathing re-education WITHOUT volumetric incentive spirometer + minimal adherence monitoring (weekly self-report without clinical contact). Duration: 3 sessions/week × 12 weeks (20 min/session). Same strengthening exercises as the EG, with breathing exercises performed without instrumental biofeedback.[5,10]

3.2 Participants

Participants will be recruited from the Associació Amics de la Música de Meliana, the Fisioterapia A Punto clinic, and from students, teaching staff and administrative and services personnel of the Universidad Cardenal Herrera CEU who voluntarily wish to participate.

3.2.1 Inclusion criteria

- Confirmed UCS diagnosis, defined by the simultaneous presence of: (a) CVA < 52°;[5] (b) rounded shoulder posture angle (RSP) > 52°;[4,10] (c) thoracic kyphosis angle > 42°.[10]
- Age between 18 and 65 years.
- Available to perform the home programme and to attend the four face-to-face assessments (weeks 0, 4, 8 and 12).
- Access to a camera-equipped device (smartphone or tablet) for remote monitoring and reinforcement.
- Ability to understand and sign the informed consent form.

3.2.2 Exclusion criteria

- Severe cervical or thoracic pathology: vertebral fracture, neoplasm, infection, active systemic inflammatory disease.
- Spinal surgery within the last 12 months.
- Respiratory pathology contraindicating use of the volumetric incentive spirometer (EG): recent pneumothorax (< 6 weeks), COPD GOLD grade III–IV, unstable bronchial asthma.
- Active physiotherapy treatment specifically targeting UCS within the last 3 months.
- Pregnancy or breastfeeding.
- Cognitive impairment or language barrier preventing comprehension of the programme.

- Simultaneous participation in another clinical trial.

3.2.3 Sample size

The calculation is based on effect sizes reported for CVA in comparable two-active-group studies (Cohen's d between 0.60 and 0.80).[5,10] Assuming d = 0.65, 80% power and α = 0.05 (two-tailed), 39 participants per group are required. With an estimated drop-out rate of 20%, the recruitment target is 48 participants per group (96 in total). An interim power analysis will be performed at 12 weeks after the enrolment of the first participant.

3.3 Variables and measurement instruments

3.3.1 Primary outcome: craniovertebral angle (CVA)

The CVA is the angle formed between the horizontal line drawn at the level of the C7 spinous process and the line connecting C7 to the ipsilateral ear tragus, measured by lateral photogrammetry.[4,5,10] CVA values < 52° are considered indicative of clinically significant FHP.[5] It is the variable with the highest sensitivity to change in therapeutic exercise studies for UCS and shows excellent inter-rater reliability with the standardised photographic protocol described in section 3.4 (ICC = 0.93).[4]

3.3.2 Rounded shoulder posture angle (RSP)

The RSP is the angle formed between the horizontal and the line connecting the acromion (posterolateral border) to the C7 spinous process in the lateral photograph. RSP values > 52° are considered clinically relevant.[4,10] Inter-rater reliability using photogrammetry with standardised markers is excellent (ICC = 0.95).[4]

3.3.3 Thoracic kyphosis angle (inclinometry)

The thoracic kyphosis angle will be measured by inclinometry, using in parallel a bubble inclinometer and the smartphone inclinometer. Photogrammetry is not applicable for this variable because, in a living subject without radiography, the superior endplate of C7 and the inferior endplate of T12 cannot be reliably identified. The spinous processes are the only palpable landmarks and are sufficient for the inclinometric method described below.

Measurement protocol

Prior to any measurement, a single assessor will identify and mark the spinous processes of T1 and T12 by palpation using a dermographic marker. T1 is located by palpating C7 (the most prominent spinous process at the cervicothoracic junction, which does not shift on neck extension) and descending one level. T12 is located by identifying L4 (at the level of the iliac crests) and ascending to T12.

The subject stands in their habitual relaxed posture with arms hanging freely at their sides. Three consecutive measurements are taken with each instrument, with a brief rest between methods, and the mean of the 3 readings is used for statistical analysis.

b.1 Bubble inclinometer (Baseline, Fabrication Enterprises Inc., White Plains, NY): The assessor places the inclinometer over the T1 spinous process and levels it to 0°. Without the subject changing posture, the inclinometer is moved to T12 and the displayed angle is recorded, corresponding to the thoracic kyphosis angle. The upper corner of the narrow side of the inclinometer is used as the contact point at both vertebrae.

This procedure (T1 zeroed to 0°, reading at T12) is described and validated in Sainz de Baranda et al.[16] The same Baseline instrument has been validated against the radiographic

Cobb angle by Hunter et al. (r = 0.62; mean difference 2.45° on Bland–Altman).[17] The intra-rater reliability of the single-inclinometer sequential method is excellent (ICC > 0.95).[16,18]

b.2 Smartphone inclinometer (iPhone 17, Clinometer app — Plaincode): The Clinometer app (Plaincode), available for iOS, is used. The assessor places the upper corner of the narrow side of the phone (screen facing laterally) over T1 and calibrates the app to 0°. Without the subject changing posture, the phone is moved to T12 with the same upper corner as the contact point and the angle displayed on screen is recorded. The same device will always be used (model and serial number registered in the measurement protocol).

The Clinometer app has demonstrated excellent intra-rater (ICC = 0.94) and inter-rater (ICC = 0.80) reliability for thoracic kyphosis measurement,[19] and very high concurrence with the digital inclinometer (R^2 = 0.85; mean difference −0.46° on Bland–Altman).[20] The minimal detectable change (MDC_{59}) for the intra-rater method with the smartphone is 5–6°; for the inter-rater method it is 9°.[20] Validity against the Cobb angle has been established for the Goniometer-Pro app (same measurement principle) with a correlation of r = 0.81 and ICC = 0.89.[21]

3.3.4 Pain: Visual Analogue Scale (VAS)

A 100-mm scale on which 0 mm equals ‘no pain’ and 100 mm equals ‘the worst imaginable pain’. The participant marks the point corresponding to their neck and interscapular pain during the past week. The score from three markings performed on the same day will be averaged.[4] The minimum clinically important difference (MCID) established for musculoskeletal pain measured with the VAS is ≥ 15 mm.[4]

3.3.5 Cervical disability: Neck Disability Index (NDI)

The Neck Disability Index is a 10-item self-reported questionnaire assessing the impact of neck pain on activities of daily living. Each item is scored from 0 to 5 points; the total score ranges from 0 to 50 points. The Spanish version has been validated by Kovacs et al.[13] with adequate psychometric properties. Test-retest reliability is excellent (ICC = 0.93).[5] The minimum clinically important difference (MCID) established by systematic review is 5 points out of 50 (10% of the scale).[23] Interpretation: 0–8% no disability; 10–28% mild; 30–48% moderate; 50–64% severe; ≥ 64% complete disability.

3.3.6 Shoulder pain and disability: Shoulder Pain and Disability Index (SPADI)

The SPADI is a self-reported questionnaire assessing pain and functional disability associated with the shoulder. It comprises 13 items distributed across two subscales: Pain (5 items) and Disability (8 items). Each item is scored from 0 to 10 on a numerical scale (0 = no pain/no difficulty; 10 = worst imaginable pain/so difficult it requires help). Each subscale score is the mean of its items, and the total score (0–100) is obtained by averaging both subscales. Higher scores indicate greater pain and disability.[22]

The SPADI shows excellent test-retest reliability (ICC = 0.91–0.95).[22] The minimum clinically important difference (MCID) has been established at 13 points out of 100 by the distribution method (0.5 SD) and at 18 points by the anchor-based method.[24] The Spanish version of the questionnaire has been validated and is available for clinical and research use. It will be administered at all assessment time points (weeks 0, 4, 8 and 12).

3.3.7 Adherence

Percentage of sessions completed out of the total planned (36 sessions over 12 weeks). Both groups will record each session in a standardised diary (paper or digital form). The EG

will additionally have the log generated by the messaging platform during asynchronous reinforcement interactions. Adequate adherence is defined as a rate ≥ 70%.

Assessment points for postural, clinical and adherence variables: week 0 (baseline), week 4 (month 1), week 8 (month 2) and week 12 (month 3 / final assessment).

3.3.8 Pulmonary function: spirometry

Pulmonary function will be assessed by forced spirometry following the protocol used by Guo et al.[15] in their randomised controlled trial on the effect of cervical and thoracic training on posture and pulmonary function in people with UCS. Measurements will be taken at only two time points: week 0 (pre-intervention) and week 12 (final post-intervention).[15]

The recorded parameters will be forced vital capacity (FVC), the FEV_1/FVC ratio and maximum voluntary ventilation (MVV), all expressed as a percentage of the predicted reference value for the participant's age, sex, height and weight.[15] The spirometer model is pending confirmation and will be specified before the start of recruitment.

Measurement protocol (adapted from Guo et al.[15]): participants will receive standardised instruction on the spirometric manoeuvre technique before the first measurement. Three measurements per parameter will be taken and the mean will be used as the final value. The spirometer will be calibrated before each measurement session, ensuring a calibration error below 3%. Tests will be performed in the upright seated position, with a nose clip, following the acceptability and reproducibility criteria of the American Thoracic Society (ATS).

3.4 Standardised photographic measurement protocol (Kinovea)

3.4.1 Adhesive markers and anatomical landmarks

Circular adhesive markers of 10 mm diameter (fluorescent red) will be placed over the following anatomical landmarks, according to the photogrammetry protocol validated in UCS studies:[4,10]

- Right ear tragus: cephalic reference for CVA.[4,5,10]
- C7 spinous process: base reference for CVA.[4,10]
- Right acromion (most prominent posterolateral border): reference for RSP.[4,10]

3.4.2 Equipment setup

Item / Parameter	Specification / Instruction
Camera / device	Smartphone with minimum 12 MP resolution. Always use the same device.
Tripod	Mandatory. Mark the exact position of the tripod legs with coloured adhesive tape to ensure reproducibility.
Camera height	At the level of the participant's C7 spinous process (approx. 1.20–1.35 m). Measure and record in each participant's data form.
Distance to participant	2.5 metres from the lens to the participant's sagittal plane. Mark on the floor.
Camera orientation	Perpendicular to the sagittal plane (right lateral photograph). Verify with a digital level: maximum deviation ± 0.5°.
Shutter mode	3-second self-timer or remote shutter release to avoid micro-movements.
Lighting	Indirect natural or homogeneous artificial light (no shadows on the markers).
Background	Plain neutral-coloured wall (white or light grey) with no interfering objects.
Image format	High-resolution JPG. Naming code: P###_week##_lateralR.jpg.
Kinovea calibration	Place a known-length reference (1-m measuring rod) in the participant's plane to calibrate the scale if distance measurements are required.

3.4.3 Participant positioning

Item / Parameter	Specification / Instruction
Footwear	Barefoot or in socks for all sessions.
Clothing	Sleeveless top or bare torso.
Foot position	Shoulder-width apart, parallel, pointing forward.
Posture	Standardised instruction: 'Stand normally, as you would while waiting in a queue'. Do NOT correct or force posture.
Gaze	Looking straight ahead at a fixed point marked on the wall at eye level.
Arms	Hanging freely at the sides of the body.

Naturalisation pause	The participant will walk on the spot for 6 steps and stop naturally before the photograph is taken.
Number of photos per session	3 consecutive photographs with 10-second intervals. The most representative photograph will be used (selected in a blinded manner by the assessor).
Breathing during the photo	Normal breathing. The photograph will be taken at the end of natural expiration.

3.4.4 Angular measurement with Kinovea

The Kinovea measurement protocol (v.0.9.5 or later) follows the procedures described in the reference studies for UCS:[4,10]

- Import the photograph into Kinovea (File > Open image).
- CVA: draw the horizontal reference line through the C7 marker; draw the second line from C7 to the ear tragus. Record the angle between both lines.
- RSP: draw the horizontal reference line; draw the second line from the acromion to C7. Record the angle between both lines.
- Record the mean of the three photographs of the day for each variable. Anonymise photographs before measurement (numeric code; no name or group visible).

3.5 Inter-rater reliability study

Prior to the start of the main trial, an inter-rater reliability study will be conducted to determine the reproducibility of the photographic measurement protocol.

3.5.1 Design and sample

- Design: test-retest reliability study, simple crossover design.
- Sample: minimum 30 volunteer participants with suspected UCS (selected by convenience), not belonging to the main trial sample.
- Assessors: 2 independent physiotherapists (Assessor A and Assessor B), trained in the photographic protocol and blinded to each other.

3.5.2 Procedure

- The 30 participants will be photographed in a single session following the standardised protocol (section 3.4).
- Photographs will be anonymised before measurement.
- Assessor A and Assessor B will independently and blindly measure CVA and RSP from the same photographs, with a minimum 48-hour interval between both measurement occasions to avoid recall bias.

3.5.3 Reliability statistics

- Intraclass correlation coefficient (ICC): two-way mixed-effects model, absolute agreement, single measurement [ICC(2,1)]. Interpretation categories:[14] ICC < 0.50 = poor; 0.50–0.75 = moderate; 0.75–0.90 = good; > 0.90 = excellent.
- Standard error of measurement (SEM = SD × √(1 − ICC)).
- Minimal detectable change at 95% (MDC_{59} = 1.96 × √2 × SEM).
- Bland–Altman plot to visualise agreement and detect systematic bias.

3.6 Intervention programme

Both groups will perform 3 home exercise sessions per week for 12 weeks (36 sessions in total), with a maximum duration of 20 minutes per session. In the first face-to-face session, the physiotherapist will instruct the participant in the correct technique for each exercise, check their execution and —exclusively for the EG— calibrate the volumetric incentive spirometer (see Annex D). The strengthening exercises have been selected and adapted from the validated exercise programmes of Seidi et al.,[10] Bae et al.,[6] Lynch et al.[7] and Jeong and Lee.[5] The diaphragmatic breathing re-education exercises are based on the protocol of Jeong and Lee[5] and that of Yan and Kim.[11]

3.6.1 Experimental Group (EG) — Session structure (20 min)

The EG session comprises two consecutive blocks. Block 1 (~8 min) includes diaphragmatic breathing re-education with the volumetric incentive spirometer (visual biofeedback of inspiratory volume), following the individualised progression protocol described in Annex D.[5] Block 2 (~12 min) comprises muscle strengthening and shortening-muscle stretching exercises.[6,7,10] Detailed exercises are presented in Annex A.

The Coach2 flow-volume incentive spirometer (4000 mL, Smiths Medical) provides visual feedback on both inspiratory flow rate and inspiratory volume. The individualised volume (V-MAX-SCM) is determined by calibration in the first face-to-face session. Progression per session: 3 reps at 25% → 3 reps at 50% → 3 reps at 75% → 1 rep at 100% of V-MAX-SCM.

3.6.2 Control Group (CG) — Session structure (20 min)

The CG performs a programme equivalent to the EG in terms of exercise type, but without using the volumetric incentive spirometer. The session comprises two blocks: Block 1 (~4 min) includes diaphragmatic breathing re-education in the supine and seated positions without instrumental biofeedback,[5,11] and Block 2 (~16 min) comprises muscle strengthening and stretching exercises, with greater training volume (3 sets per exercise versus 2 in the EG, plus a fourth strengthening exercise and an additional stretch) to equalise total session time.[6,7,10] Detailed exercises are presented in Annex B.

Methodological note: The difference in training volume between groups (necessary to equalise session time) and the absence of spirometer biofeedback in the CG are inherent limitations of the design. Any differences in outcomes may be attributed to the overall differential intervention (respiratory biofeedback + active remote reinforcement) and not exclusively to the spirometer in isolation. This limitation will be explicitly discussed in the results manuscript.

3.7 Remote reinforcement and follow-up

3.7.1 Experimental Group

- Biweekly video call (weeks 2, 4, 6, 8, 10 and 12): 15 minutes. The physiotherapist will review execution technique, answer questions and record any incidents.
- Asynchronous audiovisual material: a demonstration video sent every Monday (one complete repetition of each exercise in the corresponding block).
- Deferred feedback: the participant may send their own video at any time. The physiotherapist will respond within ≤ 48 hours with correction comments.
- Weekly adherence record: 3 questions (How many sessions did you complete? Any difficulties? Did you use the spirometer correctly?).

3.7.2 Control Group

- Minimal adherence monitoring: weekly digital form (1 question: How many sessions did you complete this week?).
- No video calls, no additional audiovisual material, no technical feedback during the 12 weeks.
- In the event of spontaneous consultation due to pain or injury: action according to the safety protocol (contact with the principal investigator, temporary withdrawal if appropriate).

3.8 Timeline

The following table summarises the study actions at each week:

Week	Action	Groups
Week 0 (baseline)	Face-to-face session: consent, initial assessment (CVA, RSP, kyphosis [inclinometry], VAS, NDI, SPADI, spirometry), programme instruction, spirometer calibration (EG only), material distribution.	EG + CG
Weeks 1–3	Home programme (3 sessions/week). Biweekly video call week 2 (EG). Adherence	EG + CG

	record.	
Week 4 (month 1)	Face-to-face assessment: CVA, RSP, kyphosis [inclinometry], VAS, NDI, SPADI, adherence. Video call week 4 (EG). Spirometer recalibration (EG).	EG + CG
Weeks 5–7	Continuation of programme. Video call week 6 (EG). Adherence record.	EG + CG
Week 8 (month 2)	Face-to-face assessment: CVA, RSP, kyphosis [inclinometry], VAS, NDI, SPADI, adherence. Video call week 8 (EG). Spirometer recalibration (EG).	EG + CG
Weeks 9–11	Continuation of programme. Video call week 10 (EG). Adherence record.	EG + CG
Week 12 (month 3)	Final face-to-face assessment: CVA, RSP, kyphosis [inclinometry], VAS, NDI, SPADI, adherence, spirometry (FVC, FEV_1/FVC, MVV). Final video call week 12 (EG).	EG + CG
6-month follow-up	Follow-up assessment (optional / recommended): CVA, VAS, NDI, SPADI by e-mail or in person.	EG + CG

4. STATISTICAL ANALYSIS

4.1 Sample description and baseline comparability

Continuous variables will be described as mean ± standard deviation (if normally distributed) or as median and interquartile range [P25–P75] (if not). Categorical variables will be expressed as absolute frequency (n) and percentage (%). Normality will be assessed using the Shapiro–Wilk test ($n < 50$). Baseline comparability will be analysed with the independent-samples t-test or Mann–Whitney U test (continuous variables) and chi-square or Fisher's exact test (categorical variables).

4.2 Primary efficacy analysis

To compare the evolution of CVA, RSP, kyphosis, VAS and NDI between groups over the four assessment points (weeks 0, 4, 8 and 12), a mixed repeated-measures ANOVA will be used (between-subject factor: group [EG vs. CG]; within-subject factor: time [4 levels]). When the assumption of sphericity is not met (Mauchly's test), the Greenhouse–Geisser correction will be applied. Pairwise comparisons (post-hoc) will be performed with Bonferroni correction. Effect size will be quantified as partial η^2 (ANOVA) and Cohen's d (pairwise comparisons).

If variables fail normality assumptions after transformation, the non-parametric alternative will be used: Friedman test (within-group) and Mann–Whitney U test (between-group) with Bonferroni correction.

4.3 Adherence analysis

Adherence (% sessions completed) will be described as median [IQR] and compared between groups with the Mann–Whitney U test. The proportion of participants achieving minimum adherence (≥ 70%) in each group will be calculated and compared with chi-square.

4.4 Inter-rater reliability analysis

ICC (model 2,1), SEM and MDC_{59} will be calculated for each postural variable (CVA, RSP, kyphosis), with 95% confidence intervals.[14] Bland–Altman plots will be produced for each variable.

4.5 Intention-to-treat analysis and missing data

The primary analysis will follow the intention-to-treat (ITT) principle: all randomised participants will be included regardless of their adherence. Missing data will be imputed using LOCF (Last Observation Carried Forward) as the primary analysis and multiple imputation as a sensitivity analysis. A per-protocol analysis will be performed as a secondary analysis, including only participants with adherence ≥ 70%.

Software: IBM SPSS Statistics v.27 (or R v.4.x with the ez and lme4 packages). Significance level $\alpha = 0.05$ (two-tailed).

4.6 Pulmonary function analysis (spirometry)

Since spirometry is measured at only two time points (weeks 0 and 12), it cannot be included in the four-time repeated-measures model described in section 4.2. The analysis of this variable will follow the approach of Guo et al.[15]: for within-group comparison (baseline → week 12) the paired-samples t-test will be used, or the Wilcoxon signed-rank test if normality is not met; for between-group comparison of change scores (Δ = week 12 − baseline) the

independent-samples t-test or Mann–Whitney U test will be used. Effect size will be expressed as Cohen's d. Parameters analysed: FVC (%), FEV_1/FVC (%) and MVV (% predicted).[15]

5. ETHICAL CONSIDERATIONS

- The protocol will be submitted for approval by the competent Research Ethics Committee (REC/IRB) before the start of recruitment.
- All participants will sign a written informed consent form, with the possibility of withdrawal at any time without consequences.
- The study will be conducted in accordance with the Declaration of Helsinki (2013 revision) and Good Clinical Practice guidelines (ICH E6 R2).
- Personal data will be processed in accordance with the EU General Data Protection Regulation (GDPR, Regulation 2016/679) and applicable national data protection legislation.
- The study will be registered on ClinicalTrials.gov or the Spanish Registry of Clinical Studies (REec) before the enrolment of the first participant.
- There is no conflict of interest between the investigators and industry.

6. REFERENCES

Listed in order of appearance in the text (Vancouver format).

1. Janda V. Muscles and Motor Control in Cervicogenic Disorders. In: Grant R, editor. Physical Therapy of the Cervical and Thoracic Spine. New York: Churchill Livingstone; 1994. p. 195-216.

2. Sepehri S, Sheikhhoseini R, Piri H, Sayyadi P. The effect of various therapeutic exercises on forward head posture, rounded shoulder, and hyperkyphosis among people with upper crossed syndrome: a systematic review and meta-analysis. BMC Musculoskelet Disord. 2024;25:105. doi: 10.1186/s12891-024-07224-4

3. Chaudhuri S, Chawla JK, Phadke V. Physiotherapeutic Interventions for Upper Cross Syndrome: A Systematic Review and Meta-Analysis. Cureus. 2023;15(9):e45471. doi: 10.7759/cureus.45471

4. Kalantariyan M, Sadeghi M, Samadi H. Manual massage versus foam rolling within the NASM corrective framework: a trial for upper crossed syndrome rehabilitation in university students. Sci Rep. 2026;16:5471. doi: 10.1038/s41598-026-35030-6

5. Jeong GH, Lee BH. Effects of Telerehabilitation Combining Diaphragmatic Breathing Re-Education and Shoulder Stabilization Exercises on Neck Pain, Posture, and Function in Young Adult Men with Upper Crossed Syndrome: A Randomized Controlled Trial. J Clin Med. 2024;13(6):1612. doi: 10.3390/jcm13061612

6. Bae WS, Lee HO, Shin JW, Lee KC. The effect of middle and lower trapezius strength exercises and levator scapulae and upper trapezius stretching exercises in upper crossed syndrome. J Phys Ther Sci. 2016;28(6):1636-9.

7. Lynch SS, Thigpen CA, Mihalik JP, Prentice WE, Padua D. The effects of an exercise intervention on forward head and rounded shoulder postures in elite swimmers. Br J Sports Med. 2010;44(5):376-81. doi: 10.1136/bjsm.2009.066837

8. Karimian R, Rahnama N, Ghasemi GA, Lenjannejadian SH. Photogrammetric Analysis of Upper Cross Syndrome among Teachers and the Effects of National Academy of Sports Medicine Exercises with Ergonomic Intervention on the Syndrome. J Res Health Sci. 2019;19(3):e00450.

9. Piri H, Hajian M, Mirkarimpour SH, Sheikhhoseini R, Rahimi M. The Effect of 12-Week Corrective Exercises on the Postural Angles of Beautician Females with Upper Crossed Syndrome: a Clinical Trial Study. Women Health Bull. 2021;8(2). doi: 10.30476/whb.2021.90790.1112

10. Seidi F, Bayattork M, Minoonejad H, Andersen LL, Page P. Comprehensive corrective exercise program improves alignment, muscle activation and movement pattern of men with upper crossed syndrome: randomized controlled trial. Sci Rep. 2020;10:20688. doi: 10.1038/s41598-020-77571-4

11. Yan X, Kim T-H. The Impact of Combined Scapular Stabilization and Breathing Training on Pain and Respiratory Function in Individuals with Upper Cross Syndrome. Appl Sci. 2025;15:6147. doi: 10.3390/app15116147

12. Yaghoubitajani Z, Gheitasi M, Bayattork M, Andersen LL. Corrective exercises administered online vs at the workplace for pain and function in the office workers with upper crossed syndrome: randomized controlled trial. Int Arch Occup Environ Health. 2022;95(8):1703-18. doi: 10.1007/s00420-022-01859-3

13. Kovacs FM, Bagó J, Royuela A, Seco J, Giménez S, Muriel A, et al. Psychometric characteristics of the Spanish version of instruments to measure neck pain disability. BMC Musculoskelet Disord. 2008;9:42.

14. Koo TK, Li MY. A Guideline of Selecting and Reporting Intraclass Correlation Coefficients for Reliability Research. J Chiropr Med. 2016;15(2):155-63.

15. Guo Y, Li M, Xie C, Liu X, Chen Y, Yang J, Wu Y, Chen S, Wang S, Lin J. Effect of the cervical and thoracic «Daoyin» training on posture and pulmonary function in patients with upper crossed syndrome: a randomized controlled trial. BMC Complement Med Ther. 2025;25:41. doi: 10.1186/s12906-025-04791-4

16. Sainz de Baranda P, Cejudo A, Santonja F, Martínez L, Andújar P, Ojeda M, et al. Description of thoracic kyphosis and lumbar lordosis using an inclinometer. RICYDE Rev Int Cienc Deporte. 2009;5(18):38-56. doi: 10.5232/ricyde2009.01803

17. Hunter DJ, Rivett DA, McKeirnan S, Snodgrass SJ. Reliability of thoracic kyphosis measurement using a Baseline bubble inclinometer in individuals with and without neck pain. Braz J Phys Ther. 2018;22(3):192-8. doi: 10.1016/j.bjpt.2018.01.008

18. Barrett E, McCreesh K, Lewis J. Reliability and validity of non-radiographic methods of thoracic kyphosis measurement: a systematic review. Man Ther. 2014;19(1):10-7. doi: 10.1016/j.math.2013.09.003

19. Elpeze G, Küçük H, Demirbüken I. Reliability of the clinometer mobile application for measuring thoracic kyphosis in young adults. Cureus. 2023;15(3):e35886. doi: 10.7759/cureus.35886

20. Şahinoğlu E, Çalık BB, Özdolap Ş, Ünlü M. Validity and reliability of smartphone inclinometry for measuring thoracic kyphosis in office workers. Clin Exp Health Sci. 2023;13:511-6. doi: 10.33808/clinexphealthsci.1038122

21. Shahri MN, Hesar NS. Validity of the smartphone goniometer application (Goniometer-Pro) for measuring thoracic kyphosis angle compared to the Cobb angle. Musculoskelet Sci Pract. 2020;49:102216. doi: 10.1016/j.msksp.2020.102216

22. Roach KE, Budiman-Mak E, Songsiridej N, Lertratanakul Y. Development of a shoulder pain and disability index. Arthritis Care Res. 1991;4(4):143-9.

23. MacDermid JC, Walton DM, Avery S, Blanchard A, Etruw E, McAlpine C, et al. Measurement properties of the neck disability index: a systematic review. J Orthop Sports Phys Ther. 2009;39(5):400-17. doi: 10.2519/jospt.2009.2930

24. Schmitt JS, Di Fabio RP. Reliable change and minimum important difference (MID) proportions facilitated group responsiveness comparisons using individual threshold criteria. J Clin Epidemiol. 2004;57(10):1008-18. doi: 10.1016/j.jclinepi.2004.02.007

ANNEX A — Full session: Experimental Group (EG) | 20 min

Frequency: 3 sessions/week for 12 weeks. Equipment required: exercise mat, elastic band (medium resistance), Coach2 flow-volume incentive spirometer 4000 mL (Smiths Medical).[5,10,11]

Block 1: Diaphragmatic breathing re-education with incentive spirometer (~8 min)

Exercise	Sets	Reps.	Time / rep.	Rest between sets	Description / Notes
Costal breathing — supine	1	8 breaths	6 s nasal insp. / 6 s oral exp.	30 s at end of block	Supine with knees flexed. Hands on lower costal flanks (lateral aspect of lower ribs). On nasal inhalation, the ribs open laterally pushing the hands outward; the movement is lateral and posterior costal expansion, ventilating the lung bases. The abdomen does not protrude; shoulders and SCM remain relaxed. Visual check with mirror if possible.
Costal breathing — seated	1	8 breaths	6 s nasal insp. / 6 s oral exp.	30 s at end of block	Seated with feet flat on the floor, spine in neutral without lumbar support. Hands on lower costal flanks. Same technique as in supine: nasal inhalation seeking lateral opening of the lower ribs and ventilation of the lung bases. Avoid elevation of the sternum, shoulders and SCM.
Coach2 flow-	4 levels:	10 reps total	Slow sustained	10–20 s	Progression: 3

volume incentive spirometer — V-MAX-SCM protocol	3+3+3+1		inhalation to the marked level	between reps. 30 s between levels	reps at 25% → 3 reps at 50% → 3 reps at 75% → 1 rep at 100% of V-MAX-SCM (see Annex D). Slow inhalation through the mouthpiece, keeping the float elevated as long as possible. Free and relaxed exhalation. Visual control: no SCM activation at any point.

Block 2: Muscle strengthening and stretching (~12 min)

Exercise	Sets	Reps.	Time / rep.	Rest between sets	Description / Notes
Cervical retraction (chin tuck)	2	10	5 s hold + 3 s return	20 s between sets	Standing or seated with back supported. Draw the chin backwards and slightly downwards (double chin) without tilting the head. Hold 5 s. Avoid shoulder elevation and cervical extension. Progress by adding light manual resistance from weeks 5–12.
Scapular retraction with elastic band	2	12	2 s concentric / 3 s eccentric	20 s between sets	Elastic band fixed at sternum height. Elbows at 90°. Draw both shoulder blades towards the spine without elevating the upper trapezius. Hold 1 s at maximum

					retraction. Return in a controlled manner. Target muscles: rhomboids, middle trapezius.
Shoulder external rotation with band	2	12	2 s concentric / 3 s eccentric	20 s between sets	Standing, elbow tucked at the side at 90° of flexion. Band at the wrist. Rotate the forearm outward without trunk compensation or shoulder elevation. Hold 1 s at end range. Target muscles: infraspinatus, teres minor.
Pectoralis major stretch — in doorframe	2	30 s each side	Static	15 s between sides	Forearm and hand resting on the doorframe at 90° and 135° of abduction (two angles to cover the sternal and clavicular heads). Step slightly forward until a pull is felt in the pectoral. No pain. Hold 30 s.
Upper trapezius + levator scapulae stretch	1	25 s each side	Static	10 s between sides	Seated or standing. Lateral cervical flexion + slight contralateral rotation. The ipsilateral hand grasps the seat to actively depress the scapula. Do not elevate the contralateral shoulder. Hold 25 s.

Note: Weeks 1–4: prioritise technical quality over number of repetitions. From week 5 onwards, if the participant correctly executes all exercises, elastic band resistance may be progressed.

ANNEX B — Full session: Control Group (CG) | 20 min

Frequency: 3 sessions/week for 12 weeks. Equipment required: exercise mat, elastic band (medium resistance). The CG performs diaphragmatic breathing re-education without a volumetric incentive spirometer,[5,11] followed by a muscle strengthening block with greater volume than the EG to equalise total session time.[6,7,10]

Block 1: Diaphragmatic breathing re-education without incentive spirometer (~4 min)

Exercise	Sets	Reps.	Time / rep.	Rest between sets	Description / Notes
Costal breathing — supine	1	8 breaths	6 s nasal insp. / 6 s oral exp.	20 s at end	Identical technique to the EG (Block 1). Supine with knees flexed. Hands on lower costal flanks. On nasal inhalation, ribs open laterally pushing the hands outward, ventilating the lung bases. No abdominal protrusion. No spirometer biofeedback: control is proprioceptive and visual (mirror or phone camera if available).
Costal breathing — seated	1	8 breaths	6 s nasal insp. / 6 s oral exp.	20 s at end	Seated with feet flat on the floor, spine in neutral without lumbar support. Hands on lower costal flanks. Same technique as in supine: nasal inhalation seeking lateral costal opening and absence of SCM and upper trapezius activation.

Block 2: Muscle strengthening and stretching (~16 min)

Exercise	Sets	Reps.	Time / rep.	Rest between sets	Description / Notes
Cervical retraction (chin tuck)	3	10	5 s hold + 3 s return	20 s between sets	Identical technique to the EG. Standing or seated, back supported. Double chin without cervical extension or shoulder elevation. Progress with manual resistance from week 5.
Scapular retraction with elastic band	3	12	2 s concentric / 3 s eccentric	20 s between sets	Identical technique to the EG. Rhomboids and middle trapezius. Avoid upper trapezius compensation.
Shoulder external rotation with band	3	12	2 s concentric / 3 s eccentric	20 s between sets	Identical technique to the EG. Infraspinatus and teres minor. Elbow tucked to the trunk throughout the movement.
Wall angels	3	10	3 s per rep (up + controlled down)	20 s between sets	Back against the wall: occiput, scapulae and sacral area in continuous contact. Arms in W position (elbows at 90°). Slide arms upward to Y position maintaining contact. Return to W in a controlled manner. Target muscles: lower trapezius, serratus anterior, infraspinatus.
Pectoralis major stretch	2	30 s each side	Static	15 s between sides	Identical technique to the

— in doorframe					EG. Two angles (90° and 135°) to cover both heads.
Upper trapezius + levator scapulae stretch	1	25 s each side	Static	10 s between sides	Identical technique to the EG. Lateral flexion + contralateral rotation. Active ipsilateral scapular depression.
Scalene stretch — supine	1	25 s each side	Static	10 s between sides	Supine with a small pillow or rolled towel under the upper thoracic region (approx. T1–T4), creating a slight cervicothoracic extension. Turn the head towards the side to be stretched and let its weight fall gently into cervicothoracic extension. This position separates the 1st and 2nd ribs from their vertebrae, placing the scalenes under tension. Sensation of traction in the lateral aspect of the neck towards the clavicle. Stop if dizziness or arm paraesthesiae appear.

The CG includes one additional strengthening exercise (wall angels) and an additional scalene stretch in the supine position, plus one extra set in the three common exercises, to compensate for the shorter time spent on the breathing block compared to the EG and to maintain total session duration at 20 minutes. The absence of incentive spirometer biofeedback and the shorter time dedicated to breathing re-education are the key experimental differences between the two groups.

ANNEX C — Photographic protocol: Standardisation checklist

This checklist must be completed by the assessor before each photography session. An unchecked box invalidates the measurement session.

Item / Parameter	Specification / Instruction
EQUIPMENT	
Tripod in marked floor position	Verify that the three legs coincide with the coloured adhesive tape mark.
Tripod height adjusted	Camera at the height of the participant's C7 spinous process (measure and record in cm).
Camera level verified	Digital level or bubble: maximum permitted deviation ± 0.5°.
Distance to participant = 2.5 m	Check with measuring tape. Participant standing position mark on the floor.
Same study camera/smartphone	Device serial number or identifier recorded.
ENVIRONMENT	
Plain background, no interfering objects	White or grey wall, no pictures, doors or shadows.
Homogeneous lighting	No back-lighting. Check that markers are visible on screen before photographing.
PARTICIPANT	
Adhesive markers correctly placed	3 markers: right ear tragus, C7, right acromion. Verify by palpation.
Appropriate clothing	Sleeveless, neutral colour (not red or orange to avoid confusion with markers).
Barefoot or in socks	No footwear at any session.
Feet in standardised position	Shoulder-width apart, parallel.
Naturalisation instruction	Participant has walked 6 steps and stopped naturally.
Looking straight ahead (reference point on wall)	Visual mark at the participant's eye level on the opposite wall.
PHOTOGRAPHY	
Strict right lateral view	Sagittal plane perpendicular to the camera lens.
3 consecutive photographs taken	10-second interval between each.
Photos anonymised before measurement	Rename with code: P###_week##_photo#.jpg
KINOVEA	
CVA measured in 3 photos and mean recorded	Angle between horizontal at C7 and line C7–ear tragus.
RSP measured in 3 photos and mean recorded	Angle between horizontal and line acromion–C7.
Assessor blinded to group assignment	No group data visible on screen during measurement.

ANNEX D — Calibration and progression protocol for the Coach2 flow-volume incentive spirometer (EG)

D.1 Initial calibration (face-to-face session, week 0)

The objective is to determine the maximum volume of air the participant can inhale without visible SCM activation. This volume is called V-MAX-SCM and constitutes the 100% reference for the entire intervention. Procedure:

6. Position the participant in upright seated posture with feet flat on the floor and spine in neutral.
7. The physiotherapist bilaterally palpates the SCM with two fingers to monitor its activation.
8. The participant performs a slow, deep inhalation through the spirometer mouthpiece. As soon as the physiotherapist detects the first SCM contraction, they say ‘stop’ and record the volume.
9. The manoeuvre is repeated 3 times with at least 1 minute rest between attempts. The mean of the 3 values is taken as V-MAX-SCM.
10. The targets are calculated: 25%, 50%, 75% and 100% of V-MAX-SCM. The levels are marked on the spirometer with coloured adhesive tape.
11. The physiotherapist records V-MAX-SCM on the participant’s data sheet.

D.2 Spirometer progression throughout the programme

Calibration will be updated at each face-to-face assessment (weeks 4 and 8). If V-MAX-SCM has increased, the percentages will be recalculated and the marks on the spirometer updated before the participant continues with the programme.

D.3 Session protocol with incentive spirometer

Level	Target volume	No. reps.	Rest between reps.	Rest before next level	Notes
Level 1	25% of V-MAX-SCM	3	10 s	20 s	Slow inhalation. The float must be maintained at the 25% mark. Free nasal exhalation.
Level 2	50% of V-MAX-SCM	3	15 s	25 s	Increase inhalation depth. Maintain the float at the 50% mark.
Level 3	75% of V-MAX-SCM	3	20 s	30 s	Deeper inhalation. Active control of SCM non-activation (visual check with mirror or camera).

Level 4	100% of V-MAX-SCM	1	—	—	Maximum volume without SCM activation. Rest 30 s before the strengthening block.

D.4 Safety considerations

- If the participant experiences dizziness, perioral paraesthesiae or dyspnoea, they must stop immediately, breathe normally and notify the principal investigator.
- Maximum forced inhalation manoeuvres (> 100% of V-MAX-SCM) will not be performed.
- The Coach2 flow-volume incentive spirometer is for individual use. Clean before each session (individual disposable mouthpiece or disinfection with 0.12% chlorhexidine).

End of document. Version 5.0 — June 2026.