Original Article

Effect of Manual Therapy in Correcting Postural Dysfunction in Patients with Upper Crossed Syndrome: A Systematic Review

Naeem ullah ,[1] Fatima Amjad ,[2] Muhammad Atif,[3] Qamar Jan, [4] Kaienatullah Khan , [5] Ayesha Zafeer ,[6] Nadia shah [7]

Abstract

Objective: This study aimed to To systematically review randomized controlled trials (RCTs) investigating the effect of manual therapy, alone or in combination with exercise, on postural correction, pain, and functional outcomes in individuals with FHP or UCS.

Study Design: A Systematic Review was conducted.

Place and duration of study: A systematic search was conducted in PubMed, Cochrane Library, and PEDro for RCTs published between 2018 and 2025.

Material and Methods: A systematic search was conducted in PubMed, Cochrane Library, and PEDro for RCTs published between 2018 and 2025. Studies were included if they examined manual therapy interventions targeting postural dysfunction in FHP/UCS populations. Data on participants, interventions, comparators, outcomes, and results were extracted. Methodological quality was assessed using the PEDro scale, and risk of bias was evaluated using the Cochrane RoB tool.

Results: Twelve RCTs, including 22–66 participants aged 18–45 years, were included. Interventions involved cervicothoracic mobilization, myofascial release, soft tissue manipulation, and combined posture correction programs, often integrated with exercise. Outcomes included craniovertebral angle (CVA), scapular position, neck pain, and functional disability. Most studies reported short-term improvements in postural alignment, pain reduction, and functional performance. Methodological quality was moderate (PEDro scores 6-7/10), and risk of bias was mainly due to lack of participant and therapist blinding

Conclusion: Manual therapy, alone or with exercise, appears effective in improving postural dysfunction and related symptoms in FHP/UCS, although evidence is limited by heterogeneity, small sample sizes, and short-term follow-up. Future high-quality RCTs with standardized protocols and long-term outcomes are warranted.

Keywords: Manual therapy, Forward head posture, Upper Crossed Syndrome, Postural dysfunction, Randomized controlled trial

1. Introduction

Upper crossed syndrome is a prevalent musculoskeletal dysfunction characterized by a predictable pattern of neuromuscular imbalance involving the cervico-thoracic and scapulo-thoracic regions. (1) This imbalance, manifested by the reciprocal tightness of the pectoralis and upper trapezius muscles alongside the inhibition of deep cervical flexors and scapular stabilizers, frequently precipitates chronic pain and functional impairments. (2) These biomechanical alterations often exacerbate postural deviations such as forward head posture and rounded shoulders, which are increasingly common in sedentary populations. (3) Postural dysfunction has become increasingly prevalent in both developed and developing countries, affecting individuals of different age groups, particularly students, office workers, and professionals who spend long hours working in static positions Prolonged poor posture can result in muscular imbalance, joint dysfunction, and biomechanical alterations in the cervical, thoracic, and shoulder regions. (4) These muscular imbalances create a characteristic "crossed pattern" of dysfunction between the ante

Lecturer , Ahmad Medical Institute , Peshawar, [1,7] Assistant Professor , Ibadat International University , Islamabad ,[2] Lecturer, School of Health Sciences, Peshawar , [3] Exercise Physiologist, Vista Care PT PC, New York, USA , [4] Resident , Lady Reading Hospital , Peshawar , [5] Lecturer , Pakistan education foundation PEF university college Peshawar [6]

Correspondence: Lecturer, Ahmad Medical Institute , Peshawar **Email:** naeemphysio58@gmail.com

rior and posterior muscle groups of the upper body, leading to abnormal alignment of the cervical spine and shoulder complex. The syndrome is commonly associated with forward head posture, rounded shoulders, and thoracic hyper-kyphosis, which together contribute to significant biomechanical alterations in the cervico-thoracic region. [3]

The prevalence of postural disorders, particularly forward head posture and rounded shoulder posture, has increased dramatically in recent decades due to technological advancements and sedentary lifestyles. Studies indicate that prolonged use of computers and mobile devices is a significant risk factor for developing postural abnormalities affecting the cervical and thoracic regions. [5] Young adults and university students represent one of the most affected populations because they often spend long hours studying, working on computers, and using smartphones. Several observational studies have reported a high prevalence of upper crossed syndrome among students and office workers due to sustained poor ergonomic conditions and repetitive postural stress. [6] Athletes may also develop upper crossed syndrome due to repetitive upper-limb movements and muscular imbalances associated with specific sports. For instance, swimmers and overhead athletes may experience changes in shoulder posture and scapular alignment that predispose them to postural dysfunction. [7] Compensatory muscular patterns resulting from these sedentary habits underscore the need for targeted rehabilitation interventions to restore postural alignment, improve neuromuscular control, and reduce pain and functional impairment. [8] Manual therapy, encompassing a diverse array of manipulative and soft tissue techniques, has emerged as a cornerstone in the conservative management of these compensatory myofascial patterns. [9]

Clinical research suggests that multimodal approaches, which integrate manipulative techniques with targeted stabilization, are particularly effective in modulating pain and improving the cranio-vertebral angle in symptomatic populations. [10] Furthermore, evidence indicates that practitioners who employ techniques like muscle energy or positional release therapy can significantly elevate pressure pain thresholds while enhancing cervical range of motion across multiple movement planes. [11]

Given the increasing prevalence of postural dysfunction and its associated musculoskeletal complications, identifying effective treatment strategies is essential for improving patient outcomes and reducing the burden of neck and shoulder disorders. Manual therapy is widely used in clinical practice; however, the current evidence regarding its effectiveness in correcting postural dysfunction associated with upper crossed syndrome remains scattered across different studies. Conducting a systematic review will allow for a comprehensive evaluation of existing literature, helping clinicians and researchers better understand the role of manual therapy in managing postural dysfunction. The findings of this review may contribute to evidence-based clinical practice by providing recommendations for physiotherapy interventions aimed at correcting postural imbalance in patients with UCS.

2. Materials & Methods

Research Question

The primary research question of this systematic review is:

Among individuals with upper crossed syndrome, how effective is manual therapy in improving postural alignment and related functional outcomes compared with other interventions?

Protocol and registration

The current systematic review was conducted in accordance with PRISMA protocol and it was registered on PROSPERO (www.crd.york.ac.uk/PROSPERO) under the registration number CRD420261296927.

PICO Framework

The PICO framework is used to define the components of the research question in systematic reviews.

Component	Description
P (Population)	Patients diagnosed with Upper Crossed Syndrome, forward head posture, or rounded shoulder posture
I (Intervention)	Manual therapy techniques such as joint mobilization, spinal manipulation, myofascial release, soft tissue mobilization, trigger point therapy, and muscle energy techniques
C (Comparison)	Exercise therapy, postural correction exercises, ergonomic training, other physiotherapy interventions, or no treatment
O (Outcome)	Improvement in postural alignment, reduction in forward head posture, improved craniovertebral angle, reduced pain, increased range of motion, and improved functional outcomes

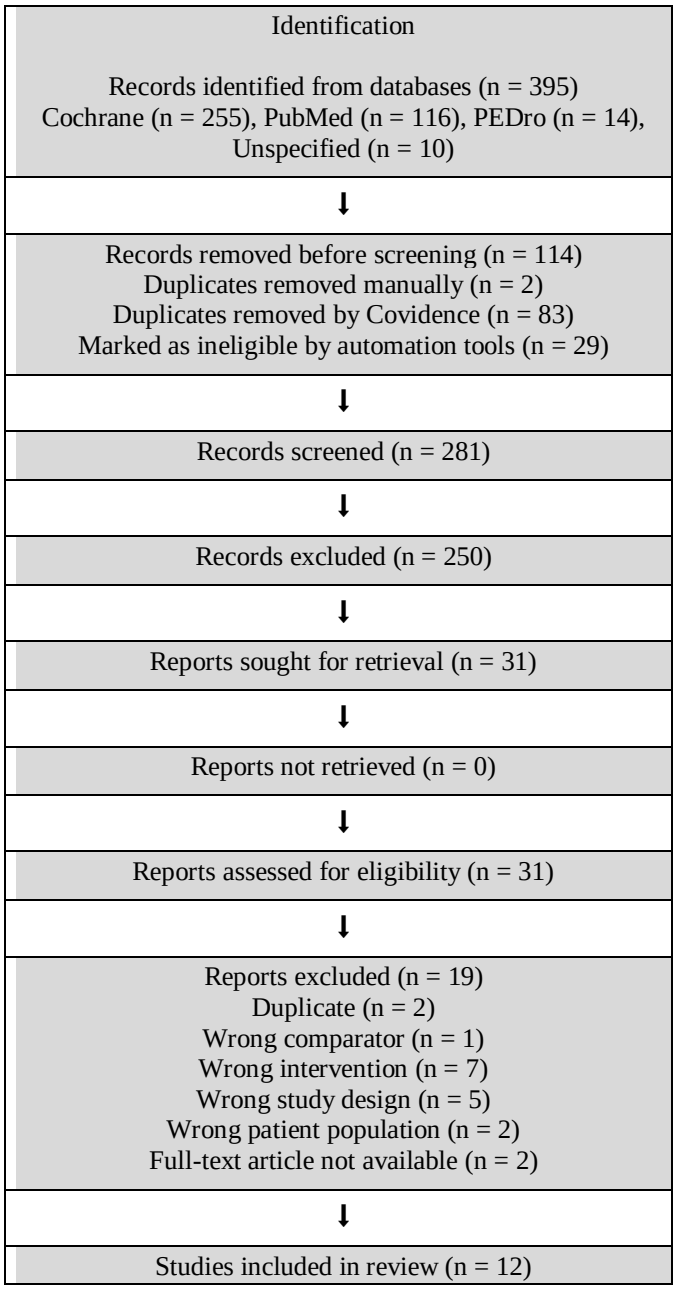
Inclusion Criteria: Studies were included in this systematic review if they met the following criteria: Studies including patients with Upper Crossed Syndrome (UCS), forward head posture, or rounded shoulders, Studies using manual therapy interventions (e.g., joint mobilization, manipulation, myofascial release, soft tissue mobilization, muscle energy technique), Randomized controlled trials, Studies reporting outcomes related to postural correction, pain reduction, range of motion, or functional improvement, Articles published between, 2018–2025, Full-text articles available, Studies published in the English language Exclusion Criteria Studies involving patients with spinal fractures, tumors, neurological disorders, or post-surgical conditions, Studies using only exercise therapy, electrotherapy, or ergonomic training without manual therapy, Case reports, case series, review articles, editorials, and conference abstracts, Articles not available in full text, Studies published in languages other than English, Studies published before 2018.

Search Strategy

An extensive search was conducted using electronic databases including PubMed, Cochrane Library, and PEDro to identify relevant studies. The search targeted studies published between 2018 and 2025. The literature search was performed on An extensive search was conducted using the electronic databases PubMed, Cochrane Library, and PEDro to identify relevant randomized controlled trials. The literature search was performed on 10 February 2026 across the three databases. According to the predefined eligibility criteria, only studies published between January 2018 and December 2025 were considered; therefore, publications from 2026 were not included. In PubMed, both Medical Subject Headings (MeSH) and free-text keywords were used. The search strategy combined the following terms using Boolean operators: ("Manual Therapy"[MeSH] OR "manual therapy" OR "joint mobilization" OR "spinal manipulation" OR "myofascial release" OR "soft tissue mobilization") AND ("Forward Head Posture" OR

"Upper Crossed Syndrome" OR "Rounded Shoulder Posture" OR "Postural Dysfunction") AND ("Randomized Controlled Trial" OR "RCT"). Similar search strategies were adapted for the Cochrane Library and PEDro databases.

PRISMA Flowchart



Data Extraction and Synthesis

Data extraction was performed independently by two reviewers using a standardized data extraction form in Covidence. The extracted information included the first author, year of publication, study design, sample size, participant characteristics, intervention and comparator details, outcome measures, follow-up duration, and main findings. Any discrepancies between the reviewers were resolved through discussion, and when consensus could not be reached, a third reviewer was consulted. The extracted data were subsequently synthesized narratively and summarized in tabular form.

Selection of the Studies

A total of 395 articles were identified from three electronic databases. Among these, 116 articles were retrieved from PubMed, 255 from the Cochrane Library, and 14 from the PEDro database. Out of the total identified studies, 114 records were removed as duplicates, of which 83 duplicates were identified and removed using Covidence, and 2 duplicate studies were removed manually. Additionally, 29 records were excluded by automation tools due to ineligibility. After removing duplicates and ineligible records, 281 studies remained for title and abstract screening. During this stage, 250 studies were excluded because they were not relevant to manual therapy, postural dysfunction, or Upper Crossed Syndrome.

The remaining 31 studies were assessed for full-text eligibility. During full-text review, 19 articles were excluded due to the following reasons: wrong intervention (n = 7) where studies did not include manual therapy, wrong study design (n = 5) such as review articles or case reports, wrong patient population (n = 2) not related to Upper Crossed Syndrome or postural dysfunction, wrong comparator (n = 1), full-text article not available (n

= 2), and duplicate studies identified during full-text review (n = 2). Finally, 12 studies met the inclusion criteria and were included in this systematic review, focusing on the effect of manual therapy in correcting postural dysfunction in patients with Upper Crossed Syndrome.

Characteristics of Included Studies

A summary of the included RCTs is presented in below Table. The articles were published between 2018 and 2025 and conducted in various regions, including Asia, Europe, North America, and the Middle East. The sample sizes ranged from 22 to 66 participants, and the ages of participants varied between 18 and 45 years. Both male and female participants were included in most studies. The participants were either individuals with forward head posture, chronic neck pain, or postural dysfunction associated with Upper Crossed Syndrome. The interventions primarily consisted of manual therapy techniques, such as myofascial release, joint mobilization, soft tissue manipulation, and combined posture correction programs, with comparators including exercise programs, placebo/manual control, or multimodal rehabilitation protocols.

Characteristics of Included RCTs

Author & Year	N	Population	Intervention	Comparator	Posture Outcome	Main Result
Anwar et al. 2024	66	FHP + chronic neck pain	Myofascial release	MRT + CBT	CVA	Combined group had greater CVA & NDI improvement
Elsayed & Alowa et 2025	60	FHP adults	CT + LP posture program	CT only	CV angle	Both improved; experimental had slightly better NDI
Ghan & Babu et al 2021	60	FHP individuals	Cervicothoracic mobilization	Placebo mobilization	Deep neck flexor strength	Experimental group increased strength
Kim et al. 2021	22	Neck pain + FHP	Sling manual therapy	Upper cervical mobilization	CVA	CTJ manipulation group had greater posture improvement.
Elgendy et al. 2024	60	FHP subjects	Manual posture correction + programs	Control exercise	CVA	All groups improved; best in combined manual group.
Ahmed et al. 2025	60	FHP + chronic neck pain	CST + manual treatment	Manual treatment alone	CVA	CST group had improved CVA & function.
Im et al. 2022	40	FHP + neck pain	MFR + neurodynamic	Exercise only	CVA	Manual group improved posture.
Joshi & Poojary et al. 2022	50	Chronic neck pain + FHP	MET + postural correction	Exercise only	CVA	MET group improved functional outcomes.
Bohunicky et al. 2024	45	FHP + imbalance	Sub occipital release + mobilization	Control manual	CVA	Manual group showed better posture.
Park et al. 2023	54	FHP individuals	TTM + SSE + CM	Exercise only	Forward head angle	Combined manual + exercise improved angles
Panihar et al. 2025	50	FHP subjects	MFR + respiratory feedback	Conventional intervention	CVA	Combined group had larger posture gains
Kim & Lee et al. 2020	48	FHP individuals	Cervical mobilization + soft tissue	Exercise only	CV angle	Manual group improved posture & pain

3. Results

The included studies were conducted in various countries, including Asia, Europe, North America, and the Middle East, with sample sizes ranging from 22 to 66 participants, aged 18–45 years. Both male and female participants were included, primarily individuals with forward head posture, chronic neck pain, or postural dysfunction related to Upper Crossed Syndrome.

Anwar et al. conducted a single-blinded RCT involving 66 university students with chronic neck pain and forward head posture. Participants were randomised into two groups: (i) Myofascial Release Technique (MRT) alone (n = 33), and (ii) MRT combined with Cognitive Behavioural Therapy (CBT) (n = 33). Both groups received two sessions per week over eight weeks. Primary outcomes included pain intensity (NPRS), craniovertebral angle (CVA), and neck disability (NDI). Both groups demonstrated statistically significant improvements in all outcome measures following intervention. However, the combined

MRT + CBT group demonstrated significantly greater improvements in CVA and NDI compared to the MRT-only group ($p < 0.05$), suggesting that a multimodal biopsychosocial approach addressing both the physical and psychological dimensions of FHP yields superior postural and functional outcomes. [12]

Elsayed and Alowa conducted a parallel-group RCT involving 60 female adults with forward head posture. Participants were randomly assigned to receive either a cervicothoracic plus lumbopelvic correction programme (experimental group, $n = 30$) or a cervicothoracic correction programme alone (control group, $n = 30$), administered over four weeks (12 sessions). Primary outcomes were the CV angle and NDI, with secondary assessment of spinal muscle electromyography (%MVIC). Both groups demonstrated statistically significant within-group improvements in CV angle and NDI across time ($p < 0.001$ and $p = 0.002$, respectively). Between-group comparisons were not statistically significant for CVA. Notably, NDI improvement was significant only in the experimental group ($p = 0.005$), suggesting that incorporating a lumbopelvic component into cervicothoracic postural correction may confer additional functional benefits in terms of reducing neck disability. [13]

Ghan and Babu conducted a single-blinded, randomised placebo-controlled trial involving 60 asymptomatic individuals with forward head posture. Participants were randomly allocated to either a placebo-controlled group receiving Grade I Maitland mobilisation ($n = 30$) or an experimental group receiving Grade IV posteroanterior central and unilateral Maitland cervicothoracic mobilisation ($n = 30$). The primary outcome was deep neck flexor (DNF) strength assessed via the craniocervical flexion test (CCFT). The experimental group demonstrated a statistically significant increase in DNF strength following Grade IV cervicothoracic mobilisation compared to the placebo group ($p < 0.05$). The authors proposed that stimulation of articular receptors in the capsuloligamentous structures via Grade IV posteroanterior pressure at C1–T3 produces a reflexogenic enhancement of deep neck flexor motor activity. This study represents the only sham-controlled trial in this review, providing a higher level of internal validity. [14]

Kim et al. conducted a single-blind RCT involving 22 patients with neck pain and forward head posture (CVA < 51°, NPRS > 3). Participants were randomised into two groups: (i) a cervicothoracic junction (CTJ) group receiving sling-based manual therapy to both the CTJ (C7–T3) and the upper cervical spine (C0–C1) ($n = 11$), and (ii) a control group receiving manual therapy only to the upper cervical spine (C0–C1) ($n = 11$). Intervention was administered over 12 sessions during four weeks. The CTJ group demonstrated statistically significantly greater improvements in CVA ($p = 0.025$) and cervical extension range of motion ($p = 0.001$) compared to the control group. Both groups showed significant within-group reductions in NPRS, NDI, and superficial cervical muscle activity, with no significant between-group differences on these secondary outcomes. [15]

Elgendy et al. conducted a four-arm RCT involving 60 subjects (52 females, 8 males; aged 18–40 years) with FHP. Participants were randomly allocated to four equal groups: Group A (postural correction exercises [PCEs] only), Group B (PCEs + scapular stabilisation exercises [SSEs]), Group C (PCEs + kinesiotaping [KT]), and Group D (PCEs + SSEs + KT). All groups received four sessions per week for four weeks. CVA, scapular position (Lateral Scapular Slide Test), and

dominant hand grip strength were assessed. All groups demonstrated statistically significant within-group improvements in CVA. Between-group analysis confirmed that the combined multimodal group (Group D: PCEs + SSEs + KT) achieved the greatest gains in CVA, optimal scapular position, and dominant hand grip strength, demonstrating superiority over all single or dual-component interventions. [16]

Ahmed et al. conducted an RCT involving 60 patients with FHP and chronic mechanical neck pain. Participants were randomised into a study group (n = 30) receiving cervical stability training (CST) plus conventional treatment modalities, and a traditional group (n = 30) receiving conventional treatment modalities alone, over three sessions per week for eight successive weeks. Primary outcomes included somatosensory evoked potential (SSEP) and CVA. The study group demonstrated statistically significant superiority across all primary and secondary outcomes ($p < 0.05$). The mean between-group difference in CVA was 7.37° (95% CI: 6.49, 8.25), representing a clinically meaningful improvement in postural alignment attributable to the addition of CST.

Cabrera-Martos et al. (cited as Im et al. in Table 1) conducted a four-week RCT involving 40 patients with chronic neck pain. Participants were randomised into an experimental group (n = 20) receiving a combined myofascial release (MFR) and neurodynamic mobilisation programme, and a control group (n = 20) receiving exercise therapy only. The experimental group demonstrated statistically significant improvements in postural alignment (CVA), pain intensity, and overall cervical function compared to the control group, indicating superior short-term therapeutic effects from the MFR plus neurodynamic protocol. [17]

Joshi and Poojary conducted an RCT involving 50 patients with non-specific chronic neck pain and FHP. The experimental group (n = 25) received post-isometric relaxation muscle energy technique (MET) combined with postural correction exercises, while the control group (n = 25) received neck range of motion treatment, delivered three times per week over three weeks. The experimental group demonstrated statistically significant improvements in NPRS, NDI, and CVA compared to the control group at post-intervention, indicating that the combination of MET with targeted postural correction exercises is more effective than range of motion treatment alone for improving pain, functional disability, and postural alignment in patients with FHP-related chronic neck pain. [18]

Bohunicky et al. conducted an RCT involving 45 individuals with FHP and postural imbalance. Participants were randomised to receive either suboccipital release combined with cervical and thoracic mobilisation (manual therapy group, n = 23) or a control manual therapy condition (n = 22). The manual therapy group receiving suboccipital release with mobilisation demonstrated statistically significantly greater improvements in CVA compared to the control manual group, suggesting that direct targeting of the suboccipital musculature and upper cervical joints provides superior postural correction by reducing suboccipital hypertonicity and restoring craniocervical alignment. [19]

Park et al. (Buttagat et al., 2023) conducted a single-blinded RCT involving 54 individuals with forward head posture. Participants were randomly allocated to a combined intervention of traditional Thai massage (TTM), scapular stabilisation exercises (SSE), and chest mobilisation (CM) (n = 27), or exercise-only with SSE and CM (n = 27). Both groups demonstrated significant

within-group reductions in forward head angle at Weeks 4 and 8. The combined TTM + SSE + CM group demonstrated statistically significantly greater reductions in forward head angle and improvements in cervical range of motion compared to the exercise-only group, indicating that the addition of traditional Thai massage to a standardised exercise and mobilisation protocol provides additional postural correction benefits. [20]

Panihar and Joshi conducted a pilot RCT involving 50 participants with forward head posture, aged 20–45 years. Participants were randomly assigned to one of four groups: control, MFR only, feedback respiratory exercises (FRE) only, or combined MFR + FRE, over six weeks. The combined MFR + FRE group demonstrated the greatest improvements in CVA compared to all other groups, with statistically significant superiority over the control group for most postural and respiratory parameters. These findings indicate that combining myofascial release with respiratory feedback training yields synergistic postural benefits beyond either modality applied in isolation. [21]

Kim and Lee et al. conducted an RCT involving 48 individuals with forward head posture. Participants were randomly allocated to receive either cervical mobilisation combined with soft tissue techniques (manual therapy group, $n = 24$) or exercise-only therapy (control group, $n = 24$). The manual therapy group demonstrated statistically significant improvements in both CV angle and pain compared to the exercise-only group at post-intervention assessment, reinforcing the role of combined cervical mobilisation and soft tissue techniques in restoring optimal craniocervical alignment and reducing FHP-associated neck pain. [22]

4. Discussion

This systematic review synthesized evidence from 12 randomized controlled trials (RCTs) that evaluated the effectiveness of manual therapy or multimodal manual based interventions for correcting postural dysfunction primarily characterized by forward head posture (FHP) or related features consistent with Upper Crossed Syndrome (UCS). The studies included a range of manual therapy techniques such as joint mobilization, myofascial release, soft tissue manipulation, and combined manual posture programs, compared with exercise based interventions, placebo/manual control, or no treatment.

Overall, the evidence demonstrates that manual therapy interventions are effective in improving postural measures, reducing pain, and enhancing functional outcomes in individuals with FHP or related postural dysfunction. For example, studies using cervicothoracic mobilization found significant improvements in muscle strength and cervical posture among participants with FHP. [14] Similarly, sling based manual therapy applied at the cervicothoracic junction produced greater improvements in craniovertebral angle (CVA), range of motion, and neck disability compared with conventional manual modalities. [15] These findings align with previous research suggesting that manual techniques targeting joint kinematics and soft tissue flexibility can modulate neuromuscular function and realign aberrant postural patterns. [3]

Combined posture correction programs that integrate manual therapy with stabilization exercises also showed significant benefits. For instance, a study by Elsayed and Alowa 2025, reported improvements in CVA and neck disability index (NDI) following a program that included cervicothoracic and lumbopelvic posture correction components. [13] Similarly, myofascial release combined with cognitive behavioral approaches resulted in greater enhancements in cervical alignment and functional outcomes. [12] These multimodal approaches recognize that postural dysfunction is multifactorial, involving mechanical, neuromuscular, and behavioral components. [23]

Several studies also demonstrated that manual therapy can produce meaningful changes in muscle activation patterns. For example, improvements in deep cervical flexor strength were observed after cervicothoracic mobilization, which may contribute to enhanced postural stability and reduced cervical stress. [14] These neuromuscular effects are supported by biomechanical evidence showing that manual techniques can reflexively reduce muscle tension and improve coordinated movement control. [5]

Despite these positive outcomes, the heterogeneity in study designs, intervention protocols, and outcome measures across trials poses challenges for drawing definitive conclusions. The included RCTs varied in terms of manual therapy techniques (e.g., mobilization, myofascial release, multimodal correction programs), frequency and duration of treatment, and comparison groups. For example, some studies combined manual therapy with exercise, while others used placebo or active control groups. This variability likely contributes to inconsistent findings regarding the magnitude and duration of postural improvements across studies (3).

Furthermore, many RCTs included small sample sizes and short follow up periods, limiting the ability to assess the long term effectiveness and sustainability of manual therapy for postural correction. Larger, well powered trials with standardized intervention protocols and long term follow up assessments are needed to improve confidence in the strength of evidence and clinical recommendations. [23]

In addition, while most studies reported statistically significant improvements, the clinical relevance of these changes (e.g., minimal clinically important differences for CVA or NDI) was not always clearly established. Future research should aim to include such thresholds to better contextualize the importance of intervention effects for patients and clinicians. Another important consideration is that many manual therapy trials are unable to blind therapists and participants due to the nature of hands on treatments. This limitation, common in physical therapy research, poses a risk of performance bias and may influence outcomes. [24] Nevertheless, assessor blinding and objective outcome measures such as CVA and EMG can help mitigate bias.

Conclusion

The findings of this systematic review suggest that manual therapy, particularly myofascial release, cervicothoracic mobilization, and multimodal interventions combining manual therapy with postural correction or stabilization exercises, is effective in improving forward head posture, craniovertebral angle, pain, cervical range of motion, and functional outcomes in individuals with Upper Crossed Syndrome. However, the overall evidence should be interpreted with caution because of the heterogeneity of intervention protocols, outcome measures, small sample sizes, and short-term follow-up across the included studies. Although the findings support the incorporation of manual therapy into physiotherapy practice for the management of postural dysfunction, well-designed randomized controlled trials with standardized intervention protocols, longer follow-up periods, and formal assessment of the certainty of evidence are required to strengthen future clinical recommendations.

Limitations

Different manual therapy techniques and treatment protocols were used, making comparisons difficult. Most studies had short follow-up periods, so long-term effects are unclear. Small sample sizes in many trials reduce statistical power. Blinding of therapists and participants was not possible in most studies, increasing risk of bias. Outcome measures varied across studies (CVA, NDI, EMG, scapular angles), limiting generalizability. Most participants were young to middle-aged adults, so results may not apply to older populations or those with comorbidities.

Disclosure /Conflict of interest:

Authors declare no conflict of interest.

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