Review Article

Effectiveness of Postural Training and Correction Techniques for Neck Pain: A Systematic Review

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ABSTRACT

Background: Neck pain represents a significant global health burden, affecting more than 50% of adults yearly. Postural training and correction techniques are common interventions, yet the relative effectiveness of these remains unclear. Thus, this systematic review aimed to evaluate the effectiveness of postural training and correction techniques in reducing pain intensity and improving functional outcomes in adults with neck pain.

Methods: A comprehensive search was conducted following PRISMA guidelines across the PubMed, EMBASE, CINAHL, PEDro, and Cochrane Library databases for randomized controlled trials published between 2010 and 2023 that examined postural training and correction techniques in adults with neck pain. Cochrane Risk of Bias Tool 2.0 evaluated the risk of bias, and evidence quality was rated through the GRADE methodology.

Results: A total of 8 RCTs (n=1,247 participants) were identified from 487 studies that fulfilled the inclusion criteria. Interventions varied widely, including proprioceptive training, ergonomic education, and specific therapeutic exercises using postural correction techniques, global postural re-education, and workplace-based interventions. High-quality evidence supports that multimodal approaches were more beneficial in reducing pain and avoiding neck disability than specific therapeutic exercises and postural education as single-component techniques.

Conclusions: Multimodal approaches that combine several treatment components, including postural training, specific strengthening exercises, and education, show an improved effect for the management of neck pain compared with single-component techniques. Future research should focus on standardizing the appropriate methods in the patient treatment protocols and determining the varying sub-groups of patients responding to different postural correction approaches.

Keywords: Disability, Neck pain, Multimodal approach, Posture, Pain management.

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INTRODUCTION

Neck pain is among the most common musculoskeletal disorders globally, with yearly prevalence estimates between 30%-50% in the adult population and lifetime prevalence estimates greater than 70%[1,2]. This condition is associated with increased disability, healthcare, and productivity costs and is the fourth most common condition that contributes to years lived with disabilities worldwide[3]. Neck pain represents a significant financial burden on leading developed nations, with direct healthcare expenses exceeding billions of dollars yearly. While many indirect costs, which may include workplace absenteeism or lost productivity, compound this burden greatly[3,4]. Neck pain has frequently increased across recent decades, especially in younger cohorts, mainly due to increased digital device use and sedentary behaviors associated with modern work and lifestyle changes. It is often multifactorial and influenced by biological, psychological, and social factors, whereas suboptimal posture contributes considerably to neck pain development[4]. Neck pain

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has become increasingly common due to modern lifestyle habits such as prolonged computer use, smartphone usage, and desk-based jobs. These behaviors significantly alter human posture and lead to new issues for the cervical spine, which is often subjected to extended static pressure. As a result, the cervical structures may undergo adaptations that increase the risk of pain and dysfunction.

People experiencing neck pain often exhibit a forward head posture and increased thoracic spine curvature (kyphosis)[5]. This change in posture might contribute to the mechanical load on the cervical spine, which, along with specific activation strategies, could negatively affect movement quality and reduce neuromuscular controll[6]. It has been shown that forward head posture can increase the load on cervical extensors by more than 300% while weakening deep cervical flexors and scapula positions. These biomechanical changes lead to compensatory patterns and strategies that initiate pain cycles for the patient. In addition to biomechanical changes, prolonged postural stress can lead to alterations in pain processing and neuroplastic changes within those pathways and are contributors to signs of symptoms that can lead to the chronification of symptoms.

Therefore, it is no surprise that practitioners have developed and reported on documented posture training and correction methods that have made their way into practice, including ergonomic education, proprioceptive training, therapeutic exercise prescription, biofeedback resources, and multi-factor interventions[7]. Postural intervention methods have progressed rapidly over recent years due to technological advancements in biofeedback mechanisms, wearable sensors, and smartphone applications that conduct real-time posture monitoring with corrections. The methodology has transformed posture education from a passive execution method to an interactive form of practice-specific, patient-centered, and intervention-based methods that would allow the intervention to be done according to the patient's self-identified concerns in conjunction with the patient's perceptions of the methods.

Despite the apparent prevalence of postural interventions in the clinic, the evidence regarding their relative efficacy remains unclear and inconsistent. Previous systematic reviews have concentrated on the specific types of postural interventions within broader intervention categories[8,9]. However, there has not yet been a comprehensive systematic review that evaluates the relative effectiveness of various postural training and correction methods, specifically for neck pain.

The absence of evidence-based guidance is particularly concerning, given the wide range of options available to clinicians. This limits their ability to confidently recommend the best management approach for patients suffering from neck pain. Additionally, without direct comparisons of these options, it becomes challenging to identify which postural strategies are effective for different patient populations or clinical situations. Therefore, this systematic review aims to investigate the effectiveness of different postural training/ correction approaches for decreasing pain intensities and improving functional outcomes in adults with neck pain to provide clinicians with evidence to determine the suitable use of these interventions and identify the priority areas for future research.

METHODOLOGY

The methodology for this systematic review adhered to the guidelines specified in the PRISMA 2020 statement[10].

Information Sources and Search Strategy

This systematic review was conducted on five major electronic databases from January 2010 to December 2023 on PubMed/MEDLINE, EMBASE, CINAHL Plus, Physiotherapy Evidence Database (PEDro) and the Cochrane Central Register of Controlled Trials. The search framework consisted of three 'domains':

1. Cervical pain conditions,
2. Postural intervention methods, and
3. Controlled trial frameworks.

Other search methods included hand-searching reference lists of eligible studies and relevant reviews, forward citations, and examination of trial registries such as ClinicalTrials.gov and the World Health Organization International Clinical Trials Registry Platform.

Inclusion Criteria

- Adult participants (≥18 years) with neck pain of indefinite duration or cause, with or without upper extremity referral patterns.
- Postural modification strategies, with educational components, ergonomic approaches in the workplace, exercise in a postural modification exercise program, real-time feedback, and multimodal interventions, including postural modification components.
- Standard care (typical physiotherapy, general exercise, manual), minimal care (minimal education, advice), or control groups (e.g. Waiting list, no treatment).
- Primary outcomes of pain intensity measures (visual analogue scale, numerical rating scale, valid pain measures), and cervical-specific disability measures (e.g. Neck disability index, valid functional measures). Secondary outcomes included quality of life measures, patient-reported improvement, work outcomes, compliance and safety.
- Randomized controlled trials published in English.

Exclusion Criteria

- Neck pain due to identifiable medical problems (trauma, infections, neoplasms, systemic inflammatory disease),
- Recent surgery subjects,
- Studies that included a postural element as one minor component of a larger treatment package with non-isolated outcomes.

Study Identification and Selection Process

Following duplicate removal, two independent reviewers completed title and abstract screening utilizing the agreed inclusion/exclusion criteria as a guide. After the title and abstract screening process, the reviewers completed an independent review of the full-text manuscripts of studies identified as potentially eligible. Disagreements were resolved by discussion and consensus, with a third reviewer as an arbitrator when required. The selection process and workflow followed PRISMA flow diagram standards.

Data Collection Process

Two reviewers independently completed data extraction using a standardized template developed for this study. The data extraction process consisted of data regarding:

- Authorship, year of publication, geographical location, number of participants per study, study design.
- Demographic characteristics, chronicity of pain, clinical presentations.
- Treatment types, treatment components, treatment duration, treatment frequency, and delivery.
- Characteristics of control intervention.
- Primary and secondary outcome measures, timing of measures.
- Descriptive statistics, effect sizes, significance values.
- Reporting of adverse events and voluntary withdrawal/adherence of participants.

For multi-arm studies, data were noted independently on each relevant comparison. Study authors were contacted when missing or unclear data were identified.

Quality Assessment

We employed the revised Cochrane Risk of Bias assessment tool (RoB 2) to evaluate study quality[11]. Evidence quality was assessed using the GRADE framework[12].

RESULTS

Study Characteristics

The 8 included RCTs involved a total of 1,247 participants from various locations. The sample sizes varied from 60 to 367 participants. Six of the studies focused on populations with chronic neck pain, while two had mixed durations. Details of the studies are shown in Table-1. The PRISMA flowchart illustrates the process of study extraction.

Risk of Bias Evaluation

Two studies[14,17] showed a low risk of bias across all categories, which suggests that they had high methodological quality. One study[15] appeared to show a generally low risk of bias that included only one unclear, presumably valid, category to limit doubts about reliability. Four studies[13,16,18,20] had multiple unclear ratings that limited the possibility of reliable evaluations, while one study[19] exhibited a high risk of bias in categories which weaken the claims of validity in its conclusions.The details are depicted in Table-2.

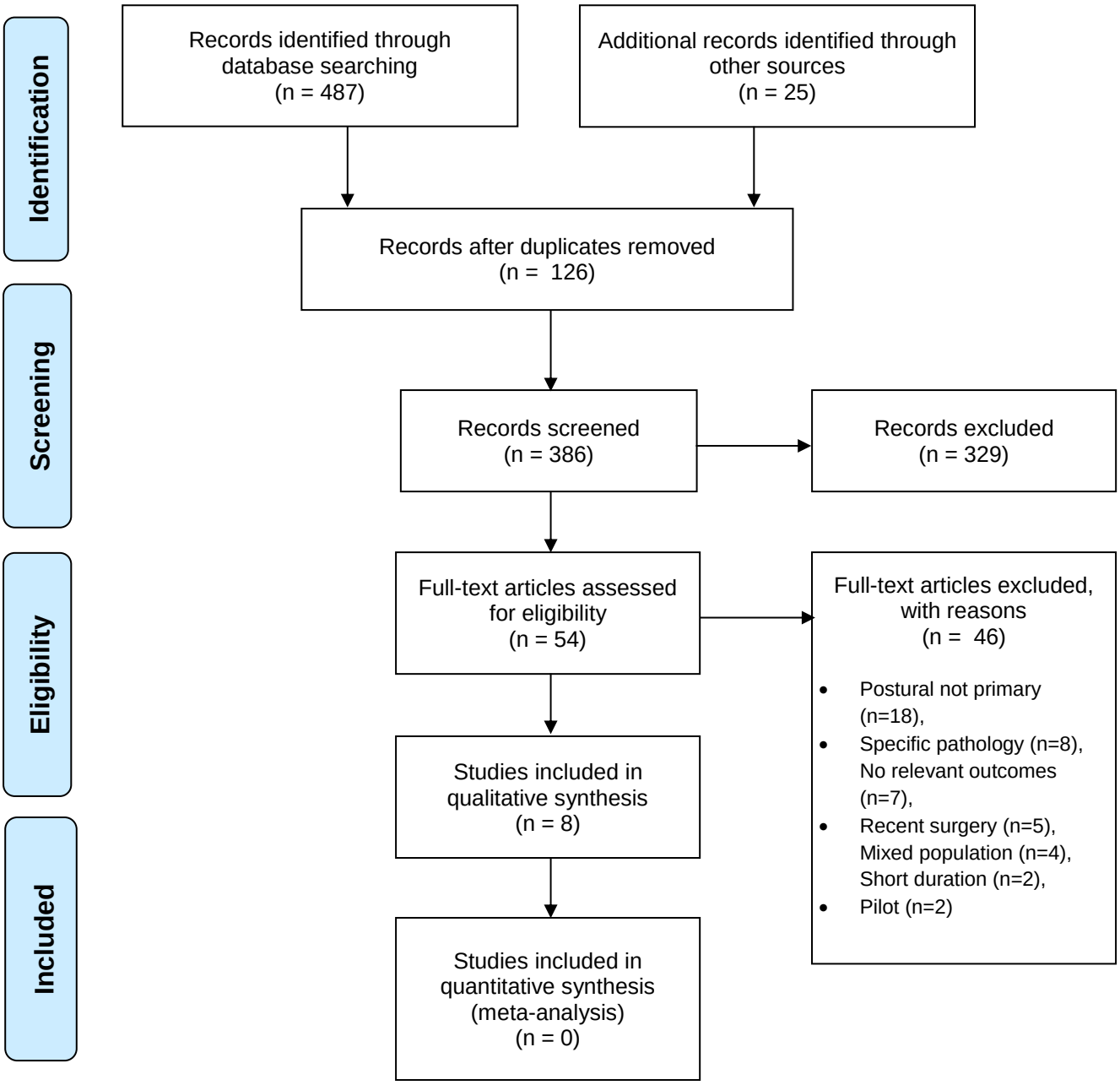

Figure-1 PRISM Flowchart for Studies Inclusion

Table-1 Characteristics of Included Studies

Study	Country	N	Population	Intervention	Comparison	Duration	Key Findings
Goudarzi et al., 2024[13]	Iran	60	Chronic non-specific neck pain	Cervical proprioceptive training + conventional PT	Conventional physiotherapy	6 weeks	Proprioceptive exercises improved postural control but did not add to clinical recovery
Mendes-Fernandes et al., 2023[14]	Portugal	94	Chronic non-specific neck pain (women)	Global Postural Re-education	Neck-specific exercises	16 weeks	GPR was as effective as specific exercises for reducing pain and disability
Johnston et al., 2021[15]	Australia	367	Office workers with/without neck pain	Ergonomics + neck-specific exercise	Ergonomics + health promotion	12 weeks	Both interventions reduced neck pain, with exercise group showing superior long-term benefits
Lauche et al., 2016[16]	Germany	114	Chronic non-specific neck pain	Tai Chi	Neck exercises; Wait-list control	12 weeks	Tai Chi and neck exercises equally effective vs. control; both reduced pain and improved quality of life
Sremakaew et al., 2023[17]	Australia	152	Neck pain with sensorimotor impairment	Manual therapy + sensorimotor control exercises	Manual therapy + exercise	6 weeks	Addition of sensorimotor training improved joint position sense and balance
Celenay et al., 2016[18]	Turkey	60	Chronic neck pain	Combined cervical and scapulothoracic exercise program	General neck exercises	6 weeks	Significantly greater improvement in intervention group
Lau et al., 2011[19]	Hong Kong	72	Chronic mechanical neck pain	Thoracic manipulation + postural education	Exercise therapy	4 weeks	Significant between-group differences favoring manipulation group
Shariat et al., 2018[20]	Iran	328	Office workers	Stretching exercise + ergonomic modifications	Control (no intervention)	11 weeks	Combined intervention effective in reducing musculoskeletal discomfort

Table-2 Risk of Bias Assessment Summary

Study	Randomization Process	Deviations from Intended Interventions	Missing Outcome Data	Measurement of Outcome	Selection of Reported Result	Overall Risk of Bias
Goudarzi et al., 2024[13]	✓	?	✓	?	✓	?
Mendes-Fernandes et al., 2023[14]	✓	✓	✓	✓	✓	✓
Johnston et al., 2021[15]	✓	✓	✓	?	✓	✓
Lauche et al., 2016[16]	✓	?	✓	?	✓	?
Sremakaew et al., 2023[17]	✓	✓	✓	✓	✓	✓
Celenay et al., 2016[18]	✓	?	✓	?	✓	?
Lau et al., 2011[19]	?	✗	?	✗	?	✗
Shariat et al., 2018[20]	✓	?	✓	?	✓	?

Low risk: ✓, high risk: x, unknown risk: >

Effects of Interventions

Proprioceptive Training

Goudarzi et al.[13] found that proprioceptive exercises improved postural control strategies in patients with chronic neck pain. However, there was no additional clinical benefit regarding pain or disability in comparison to a group of conventional physiotherapy.

Global Postural Re-Education

Mendes-Fernandes et al.[14] found that Global Postural Re-education was equally effective to neck-specific exercises for pain intensity, disability, and postural control in women with chronic neck pain.

Workplace-Based Interventions

Johnston et al.[15] reported that both ergonomic interventions combined with neck-specific exercise and ergonomic interventions combined with health promotion effectively reduced neck pain intensity in office workers, noting that the exercise group sustained their improvements better longer.

Tai Chi and Postural Awareness Training

Lauche et al.[16] tested Tai Chi against conventional neck exercises and a wait-list control in 114 people with chronic neck pain. Tai Chi and neck exercises were significantly better than wait-list control for reducing pain intensity; Tai Chi had an average difference of -10.5mm on VAS compared to control. Both active interventions also offered improvements in functional disability and quality of life compared to control.

Sensorimotor Control Training

Sremakaew et al.[17] studied the effects of neck-specific sensorimotor control training added to manual therapy and neck-specific exercises in 152 participants. The 2 × 2 factorial design yielded four groups: manual therapy plus exercise (control), sensorimotor plus manual therapy plus exercise, balance training plus manual therapy plus exercise, and sensorimotor plus balance plus manual therapy plus exercise. All groups improved primary and secondary outcomes, but joint position sense and balance in neck torsion improved most with the sensorimotor plus balance exercise training approach.

Exercise-Based Postural Training

Celenay et al.[18] found that postural alignment exercises involving the cervical and scapulothoracic regions were significantly more effective than general cervical exercises in reducing pain and disability.

Manual Techniques with Postural Education

Lau et al.[19] found that thoracic manipulation combined with postural education was more effective than exercise therapy alone for chronic mechanical neck pain.

Ergonomic Modifications Plus Exercise

Shariat et al.[20] found that stretching exercises with ergonomic modifications effectively reduced musculoskeletal discomfort in office workers compared to no intervention at all.

Quality of Evidence

Using the GRADE methodology, exercise-based postural training received a rating of moderate for pain outcomes and low for disability outcomes. Workplace-based ergonomic interventions received a rating of moderate for both pain and disability outcomes. Proprioceptive training and global postural re-education were rated low to moderate because of the small number of trials and the applied risk of bias across the studies.

DISCUSSION

This systematic review examined the efficacy of various types of postural training and correction methods for managing neck pain. Evidence indicates that postural interventions can be efficacious in reducing pain intensity and improving neck-specific disability, with the most substantial evidence supporting multimodal approaches combining various components over single components.

Exercise-based postural training programs targeting postural muscle imbalances have demonstrated efficacy. These programs generally addressed the individual elements of postural dysfunction, including forward head and rounded shoulder posture and thoracic kyphosis, through strengthening and stretching exercises for postural muscle adaptation[16,20].

Combining workplace interventions that included ergonomic modifications and exercise-based neck-specific tasks was preferable. It illustrated longer-term benefits compared to ergonomic education alone, suggesting promoting behaviour across environmental and individual capacities[15,20].

The consideration of postural awareness was also identified as an important factor among studies illustrating that postural awareness improved with neck pain reduction regardless of intervention type. This finding signifies that postural awareness may be a mechanism shared among various postural interventions for efficacy[21-22].

Strengths and Limitations

There are numerous strengths to this systematic review, including a thorough search strategy, strong methodological appraisal using validated tools and inclusion of only RCTs. However, it is prudent to note that there are some limitations. There was heterogeneity in interventions, comparisons and outcome measures, which precluded comprehensive meta-analyses. Because there was a risk of bias in many of the studies, the results must be interpreted cautiously. Implications for practice and research

For clinicians in particular, the findings from this review suggest consideration of multiple elements of postural interventions as part of their management of neck pain. Combined interventions reported superior effectiveness; hence, interventional strategies which target multiple aspects of postural dysfunction may be more valuable than isolated techniques.

Future studies should standardize interventions to allow more direct comparisons between different approaches. Studies that identify subgroups of patients more likely to benefit from particular postural approaches would contribute to better clinical management.

CONCLUSION

This systematic review provides evidence of the effectiveness of specific postural training and correction strategies for managing neck pain. Exercise-based approaches, workplace interventions combining ergonomic changes with some specific training, and multimodal interventions were reported to have some effectiveness when compared to single-component interventions. Overall, the evidence suggests that postural interventions incorporating active elements and multiple components should be considered as part of a broader approach to neck pain management.

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None.

Author Contributions

Faraz Iqbal Tipu contributed to the concept and design of the study. **Sana Subhan** was involved in data collection and initial drafting. **Maimoona Abdul Jalil** assisted with literature review and data analysis. **Akbar Mughal** contributed to data interpretation and critical revisions. **Sonia Siddiqui** provided final approval and overall supervision of the project. All authors reviewed and approved the final version of the manuscript.

Ethical Approval

Not applicable.

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None.

Conflict of Interests

None.

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