

## Effect of McKenzie Cervical Exercise on Neck Pain in Forward Head Posture: A Systematic Review

Nur Hamida<sup>1</sup>, Rizky Wulandari<sup>2</sup>, Lailatuz Zaidah<sup>3</sup>

<sup>1-3</sup>Physiotherapy Study Program, Faculty of Health Sciences, Universitas 'Aisyiyah Yogyakarta, Sleman, Special Region of Yogyakarta, Indonesia

Corresponding author:

Name: Nur Hamida

E-mail: [nurhamida563@gmail.com](mailto:nurhamida563@gmail.com)

Received 13 April 2026; Revised 17 April 2026; Accepted 20 April 2026; Published 12 May 2026

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### Abstract

**Background:** Forward Head Posture (FHP) is a common postural disorder characterized by anterior displacement of the head, resulting in increased mechanical stress on the cervical spine and neck musculature. The widespread use of smartphones and computers has contributed to the increasing prevalence of FHP and associated neck pain. McKenzie Cervical Exercise, based on the Mechanical Diagnosis and Therapy (MDT) approach, is frequently used to improve posture, reduce pain, and restore cervical function. However, evidence regarding its effectiveness in individuals with FHP remains inconsistent.

**Objective:** This study aimed to systematically review the effectiveness of McKenzie Cervical Exercise in reducing neck pain among individuals with FHP.

**Methods:** This systematic review followed the PRISMA 2020 guidelines. Literature searches were conducted through PubMed, PEDro, and Google Scholar for studies published between 2016 and 2025. Eligible studies included randomized controlled trials, experimental, and quasi-experimental studies involving individuals with FHP who received McKenzie Cervical Exercise and reported neck pain outcomes. A total of 12 studies met the inclusion criteria and were analyzed narratively.

**Results:** Most studies reported statistically significant reductions in neck pain ( $p < 0.05$ ), accompanied by improvements in cervical range of motion, craniovertebral angle, posture, and functional outcomes. Several studies also demonstrated increased cervical flexibility and reduced muscle tension following intervention.

**Conclusion:** McKenzie Cervical Exercise appears effective in reducing neck pain and improving cervical function in individuals with FHP. Further high-quality randomized controlled trials are recommended to strengthen the evidence base.

### Keywords

McKenzie Exercise; Forward Head Posture; Neck Pain; Physical Therapy Modalities; Posture

### Introduction

Neck pain is one of the most prevalent musculoskeletal disorders worldwide and represents a major contributor to disability and reduced quality of life.<sup>1,2</sup> Global epidemiological data indicate a continuous increase in the burden of neck pain, with projections estimating up to 269 million cases by 2050, reflecting a substantial rise compared to previous decades.<sup>2,3</sup> This trend is closely associated with modern lifestyle factors, particularly prolonged sedentary behavior and extensive use of digital devices, which promote sustained non-ergonomic postures.<sup>4,5</sup>

Among these postural abnormalities, Forward Head Posture (FHP) has emerged as one of the most common conditions affecting individuals across various age groups.<sup>6,7</sup> FHP is characterized by anterior displacement of the head relative to the trunk in the sagittal plane, accompanied by upper cervical extension and lower cervical flexion.<sup>8</sup> This altered alignment leads to increased mechanical loading on cervical structures, muscular imbalance, and impaired neuromuscular control.<sup>8</sup> Evidence suggests that FHP is strongly associated with increased neck pain intensity, reduced muscle endurance, and functional disability.<sup>6,9</sup>

The prevalence of FHP has risen significantly in recent years, particularly among populations with high exposure to digital devices.<sup>10</sup> Studies report that a large proportion of individuals maintain prolonged forward head positioning during daily activities, contributing to cumulative biomechanical stress and musculoskeletal dysfunction.<sup>11</sup> In addition, epidemiological findings indicate that FHP is not only associated with neck pain but also with broader impairments, including decreased cervical proprioception, reduced postural stability, and diminished functional capacity.<sup>12,13</sup>

Exercise-based interventions are widely recommended as first-line management strategies for neck pain associated with FHP.<sup>14</sup> Systematic evidence suggests that therapeutic exercises can improve craniovertebral angle, reduce pain intensity, and enhance functional outcomes in individuals with postural dysfunction.<sup>15</sup> Among these interventions, McKenzie Cervical Exercise derived from the Mechanical Diagnosis and Therapy (MDT) approach has gained attention due to its emphasis on repeated directional movements, postural correction, and patient self-management. This approach aims to restore normal cervical alignment, reduce mechanical stress, and improve neuromuscular coordination.<sup>16</sup>

Several primary studies have reported that McKenzie Cervical Exercise is effective in reducing neck pain and improving cervical function in individuals with FHP and related conditions.<sup>16,17</sup> However, despite the growing number of studies, the existing evidence remains heterogeneous in terms of study design, population characteristics, intervention protocols, and outcome measures.<sup>18</sup> Furthermore, previous reviews have generally focused on broader exercise interventions or mixed populations, rather than specifically synthesizing evidence on McKenzie Cervical Exercise in individuals with Forward Head Posture.<sup>18</sup>

Another critical limitation in the current literature is the lack of consistent methodological rigor, including variations in diagnostic criteria for FHP, outcome assessment tools, and intervention duration. These inconsistencies limit the comparability of findings and hinder the development of clear clinical recommendations.<sup>19</sup> Therefore, a focused and systematic synthesis of available evidence is necessary to clarify the effectiveness of McKenzie Cervical Exercise in this specific population.

Based on these considerations, this study aims to systematically review the effectiveness of McKenzie Cervical Exercise in reducing neck pain among individuals with Forward Head Posture. By synthesizing current evidence, this review seeks to provide a clearer understanding of its clinical value and to inform evidence-based physiotherapy practice.

## Methods

This study was conducted as a systematic review to evaluate the effectiveness of McKenzie Cervical Exercise in reducing neck pain among individuals with Forward Head Posture (FHP). The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure transparency, methodological rigor, and reproducibility. The protocol for this review was not registered in PROSPERO.

The population of interest included individuals presenting with Forward Head Posture, defined as anterior displacement of the head relative to the trunk, commonly quantified using the craniovertebral angle (CVA). The intervention examined was McKenzie Cervical Exercise based on the Mechanical Diagnosis and Therapy (MDT) approach, which involves repeated cervical movements and postural correction strategies. The primary outcome was neck pain intensity, while secondary outcomes included cervical range of motion (ROM), craniovertebral angle (CVA), and functional disability.

A comprehensive literature search was conducted across three electronic databases: PubMed, Physiotherapy Evidence Database (PEDro), and Google Scholar. These databases were selected to ensure broad coverage of clinical and rehabilitation studies. The search was limited to articles published between January 2016 and December 2025. A combination of keywords and Boolean operators was used, with the following core search string: ("Forward Head Posture" OR "FHP") AND ("McKenzie Exercise" OR "McKenzie Cervical Exercise" OR "Mechanical Diagnosis and Therapy") AND ("Neck Pain" OR "Cervical Pain"). The search strategy was adapted for each database, including the use of Medical Subject Headings (MeSH) in PubMed where applicable.

Eligibility criteria were defined prior to the search process. Studies were included if they involved participants with FHP, applied McKenzie Cervical Exercise as the primary intervention, used experimental, quasi-experimental, or randomized controlled trial designs, and reported outcomes related to neck pain using validated instruments. Only full-text articles published in English were considered. Studies were excluded if they were review articles, case reports, conference abstracts, non-peer-reviewed publications, or did not report relevant outcomes.

The study selection process was performed in several stages. All retrieved records were compiled, and duplicate entries were removed. Two independent reviewers screened titles and abstracts to identify potentially eligible studies. Full-text articles were then assessed against the inclusion criteria. Disagreements between reviewers were resolved through discussion until consensus was reached.

Data extraction was conducted using a standardized form to ensure consistency and completeness. Extracted data included study design, sample size, participant characteristics (age and sex), intervention protocols (type, frequency, and duration), outcome measures, and main findings. This process allowed systematic comparison across studies and minimized the risk of selective reporting.

The characteristics of the included studies are summarized in Table 1, which provides an overview of study design, participants, interventions, and outcomes to facilitate comparison across studies. The primary outcome, neck pain intensity, was assessed using validated instruments such as the Numerical Rating Scale (NRS), Visual Analog Scale (VAS), and Borg CR10 scale, which are widely recognized for their reliability and validity in musculoskeletal pain assessment.<sup>2</sup> Secondary outcomes included cervical range of motion (ROM), craniovertebral angle (CVA) as a measure of postural alignment, and functional disability assessed using instruments such as the Neck Disability Index (NDI).<sup>3</sup>

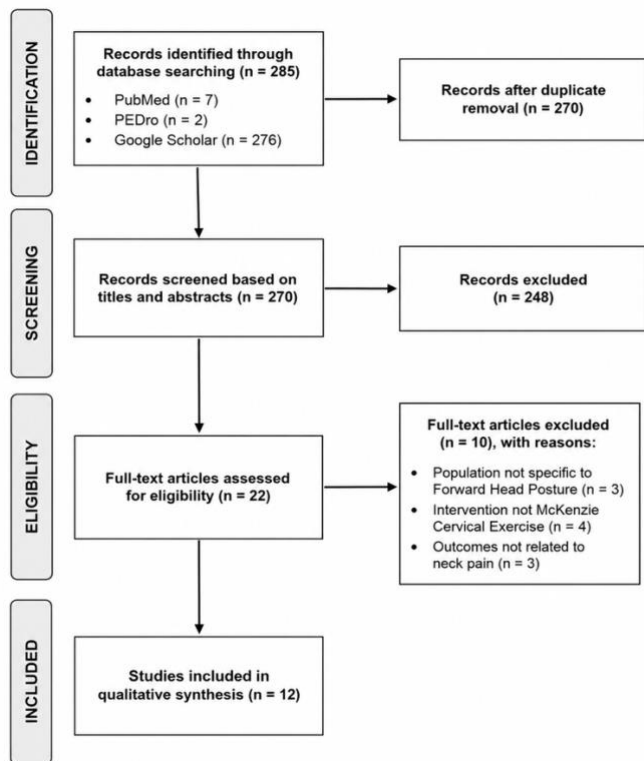
The methodological quality and risk of bias of the included studies were assessed using the PEDro scale, which is commonly used in physiotherapy research to evaluate internal validity and statistical reporting. The PEDro scale includes criteria such as random allocation, allocation concealment, blinding, and adequacy of follow-up. Studies were classified as high quality (scores  $\geq 6$ ), moderate quality (scores 4–5), or low quality (scores  $< 4$ ).<sup>2</sup> However, several studies did not provide sufficient methodological detail to fully assess all criteria.

Data synthesis was performed using a narrative approach due to heterogeneity in study design, intervention protocols, and outcome measures. Quantitative meta-analysis was not conducted because of the lack of homogeneity across studies. Instead, findings were synthesized descriptively by examining the direction and consistency of results across studies. To enhance clarity, the number of studies reporting statistically significant outcomes ( $p < 0.05$ ) was summarized and compared with those reporting non-significant findings. Where available, effect sizes and confidence intervals were also considered, although these were not consistently reported. No statistical software was used, as the analysis did not involve quantitative pooling of data. All findings were derived from extracted data and cross-study comparison. As this study was based solely on previously published data, ethical approval was not required. Where available, effect sizes and confidence intervals were extracted and reported. However, most included studies did not consistently provide effect size measures or confidence intervals, limiting quantitative comparison across studies.

## Results

The results are presented to describe the study selection process, characteristics of included studies, synthesis of outcomes, and methodological quality of the evidence regarding the effectiveness of McKenzie Cervical Exercise in reducing neck pain among individuals with Forward Head Posture (FHP). The study selection process followed PRISMA guidelines. A total of 285 records were identified from three databases (PubMed  $n = 7$ ; PEDro  $n = 2$ ; Google Scholar  $n = 276$ ). After removal of duplicates and initial screening of titles and abstracts, 22 articles were considered potentially eligible and underwent full-text review. Of these, 10 studies were excluded due to mismatch in population, intervention, or outcome measures. Consequently, 12 studies met the inclusion criteria and were included in the final synthesis.

To ensure transparency and reproducibility in the study selection process, a structured screening procedure was conducted in accordance with PRISMA 2020 guidelines. All identified records from the selected databases were systematically screened through multiple stages, including duplicate removal, title and abstract screening, and full-text eligibility assessment. Each stage aimed to ensure that only studies meeting the predefined inclusion criteria were retained for analysis. The detailed process of study identification, screening, eligibility assessment, and final inclusion is summarized in the following text-based flowchart (Figure 1).



**Figure 1.** PRISMA 2020 flow diagram of study selection process

To provide a comprehensive overview of the included evidence, the characteristics of all selected studies are summarized in Table 1. The table presents key methodological and clinical aspects, including study design, sample size, intervention protocols, outcome measures, and principal findings. This structured presentation facilitates comparison across studies and supports the synthesis of evidence related to the effectiveness of McKenzie Cervical Exercise in individuals with Forward Head Posture.

**Table 1.** Characteristics of Included Studies

No	Author (Year)	Study Design	Sample Size	Intervention	Outcome Measures	Main Findings
1	Kim et al. (2021) <sup>20</sup>	Randomized Controlled Trial	30	McKenzie cervical exercise	Borg CR10, cervical flexibility	Significant reduction in neck pain and improved flexibility
2	Nurhidayanti & Yuliono (2022) <sup>21</sup>	Pre–post study	40	McKenzie cervical exercise	Numerical Rating Scale (NRS)	Significant reduction in neck pain and muscle spasm
3	Elviani (2024) <sup>22</sup>	Quasi-experimental	25	McKenzie cervical exercise	NRS	Significant reduction in neck pain (p < 0.05)
4	Kartika et al. (2023) <sup>23</sup>	Experimental	20	McKenzie vs isometric exercise	Pain scale, postural assessment	Both interventions improved posture and reduced pain
5	Erina et al. (2023) <sup>24</sup>	Quasi-experimental	24	McKenzie vs isometric exercise	Functional neck assessment	McKenzie more effective in improving neck function
6	Kong et al. (2021) <sup>25</sup>	Experimental	30	McKenzie cervical exercise	Craniovertebral angle (CVA), ROM	Significant improvement in posture and ROM
7	Avaghade et al. (2023) <sup>26</sup>	Experimental	120	McKenzie + spinal stabilization	Pain scale, postural assessment	Significant reduction in pain and improved posture
8	Iswari et al. (2021) <sup>27</sup>	Quasi-experimental	20	McKenzie + FHP exercise	Pain scale, postural assessment	Significant reduction in neck pain
9	Shoukat et al. (2024) <sup>28</sup>	Experimental	40	McKenzie vs McKenzie Bruegger +	NRS, ROM, NDI	Significant improvement in ROM and reduction in pain
10	Laksmi RH et al. (2024) <sup>29</sup>	Quasi-experimental	30	McKenzie cervical exercise	CVA, posture assessment	Significant improvement in craniocervical angle and forward head posture following McKenzie cervical exercise intervention
11	Balthillaya et al. (2022) <sup>30</sup>	Systematic review	Not applicable	Postural interventions (including McKenzie)	Multiple outcomes	Improvement in posture and pain reduction
12	Chaiyawijit & Kanlayanaphotpom (2024) <sup>31</sup>	Randomized Controlled Trial	40	McKenzie vs cranio-cervical flexion	Pain scale, CVA, muscle endurance	Both interventions reduced pain and improved function

The included studies comprised randomized controlled trials, quasi-experimental, and experimental designs, with sample sizes ranging from 20 to 120 participants. The interventions primarily involved McKenzie Cervical Exercise, either as a standalone intervention or in combination with other exercise approaches. Outcome measures varied across studies but predominantly included validated pain scales such as the Numerical Rating Scale (NRS) and Visual Analog Scale (VAS), as well as measures of cervical range of motion (ROM), craniocervical angle (CVA), and functional outcomes such as the Neck Disability Index (NDI). To enhance clarity and provide a structured synthesis of findings, the outcomes of the included studies were categorized based on the type of measured variables and statistical significance. This approach allows identification of patterns and consistency across studies without duplicating detailed information already presented in Table 1. The summary of outcomes is presented in Table 2.

**Table 2.** Summary of Outcomes Across Included Studies

Outcome Category	Number of Studies (n=12)	Significant Results (p < 0.05)	Non-significant Results	Summary Description
Neck pain reduction	12	10	2	Most studies reported significant reduction using NRS, VAS, or Borg CR10
Cervical ROM improvement	8	7	1	Consistent improvement in cervical mobility
Craniovertebral angle (CVA)	6	6	0	All studies showed postural improvement
Functional outcomes (NDI, endurance)	5	5	0	Improvement in neck function and muscle endurance
Combined outcomes (pain + posture)	7	6	1	Multidimensional improvements observed

Across the included studies, reduction in neck pain was the most consistently reported outcome, with 10 out of 12 studies demonstrating statistically significant improvements ( $p < 0.05$ ). Improvements in cervical ROM and postural alignment, particularly as measured by CVA, were also consistently reported. Functional outcomes, including disability and muscle endurance, showed improvement in all studies that assessed these variables. The methodological quality of the included studies varied across designs, with randomized controlled trials generally demonstrating higher internal validity compared to quasi-experimental studies. Although the majority of studies reported statistically significant outcomes, effect size measures and confidence intervals were not consistently available across studies. Therefore, the magnitude of the intervention effect could not be quantitatively compared. The detailed assessment using the PEDro scale is presented in Table 3.

**Table 3.** Risk of Bias Assessment Using PEDro Scale

No	Author (Year)	Randomization	Allocation Concealment	Blinding	Follow-up Adequate	Between-group Comparison	PEDro Score	Quality Level
1	Kim et al. (2021) <sup>20</sup>	Yes	No	No	Yes	Yes	6	High
2	Nurhidayanti & Yuliono (2022) <sup>21</sup>	No	No	No	Yes	No	4	Moderate
3	Elviani (2024) <sup>22</sup>	No	No	No	Yes	No	4	Moderate
4	Kartika et al. (2023) <sup>23</sup>	Yes	No	No	Yes	Yes	5	Moderate
5	Erina et al. (2023) <sup>24</sup>	No	No	No	Yes	Yes	5	Moderate
6	Kong et al. (2021) <sup>25</sup>	Yes	No	No	Yes	Yes	6	High
7	Avaghade et al. (2023) <sup>26</sup>	Yes	Yes	No	Yes	Yes	7	High
8	Iswari et al. (2021) <sup>27</sup>	No	No	No	Yes	No	4	Moderate
9	Shoukat et al. (2024) <sup>28</sup>	Yes	Yes	No	Yes	Yes	7	High
10	Laksmi RH et al. (2024) <sup>29</sup>	No	No	No	Yes	No	4	Moderate
11	Balthillaya et al. (2022) <sup>30</sup>	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
12	Chaiyawijit & Kanlayanaphotpom (2024) <sup>31</sup>	Yes	Yes	Yes	Yes	Yes	8	High

Overall, the quality of the studies ranged from moderate to high. Randomized controlled trials generally demonstrated higher methodological quality, particularly in domains such as randomization and between-group comparisons. However, blinding was rarely implemented, which may introduce potential bias. Quasi-experimental studies showed lower methodological scores, primarily due to the absence of randomization and allocation concealment. In terms of comparative effectiveness, two studies reported that McKenzie Cervical Exercise produced outcomes comparable to other exercise interventions, rather than demonstrating superiority. No studies reported negative outcomes or worsening of symptoms following the intervention. Overall, the findings indicate a consistent pattern of improvement in neck pain and related functional outcomes following McKenzie Cervical Exercise in individuals with Forward Head Posture.

**Discussion**

This systematic review synthesized current evidence regarding the effectiveness of McKenzie Cervical Exercise in reducing neck pain among individuals with Forward Head Posture (FHP). Overall, the findings demonstrate a consistent pattern of improvement in pain intensity, cervical function, and postural alignment across the included studies, although the strength of evidence varies depending on study design and methodological quality.

The primary finding of this review indicates that McKenzie Cervical Exercise is associated with a reduction in neck pain in the majority of included studies, with 10 out of 12 studies reporting statistically significant improvements. This consistency suggests that the intervention has a clinically meaningful effect, particularly when applied in populations with postural dysfunction such as FHP. These findings are in line with previous research demonstrating that exercise-based interventions can effectively reduce musculoskeletal pain by improving biomechanical alignment and neuromuscular control.<sup>9,12,18</sup> The repeated directional movements characteristic of the McKenzie approach may contribute to centralization of symptoms and reduction of mechanical stress on cervical structures, thereby alleviating pain.

In addition to pain reduction, improvements in cervical range of motion (ROM) and craniovertebral angle (CVA) were consistently reported. These outcomes reflect not only symptomatic relief but also functional and postural improvements, which are essential in addressing the underlying mechanisms of FHP. Restoration of cervical alignment reduces abnormal loading on soft tissues and joints, thereby contributing to long-term symptom management.<sup>14,15</sup> The improvement in CVA observed across all relevant studies further supports the role of McKenzie Cervical Exercise in correcting postural deviations, which is a key factor in preventing recurrence of symptoms.

Functional outcomes, including neck disability and muscle endurance, were also positively influenced by the intervention. Although fewer studies assessed these variables, all reported significant improvements, indicating that McKenzie Cervical Exercise may extend beyond pain relief to enhance overall functional capacity. This is particularly relevant in clinical settings, where functional recovery is a primary goal of physiotherapy interventions.<sup>1</sup>

Despite these positive findings, the interpretation of results must consider the methodological quality of the included studies. The PEDro assessment revealed that while several randomized controlled trials demonstrated high methodological quality, a substantial proportion of studies were quasi-experimental with moderate scores. The lack of blinding across most studies represents a potential source of bias, particularly in subjective outcomes such as pain measurement. Additionally, the absence of allocation concealment in several studies may increase the risk of selection bias. These limitations reduce the overall certainty of the evidence

and highlight the need for more rigorously designed trials. In addition, the potential for publication bias should be considered, as studies reporting positive results are more likely to be published than those with non-significant findings. Selection bias may also be present due to variations in inclusion criteria and sampling methods across studies. These factors may influence the overall interpretation of the findings.

Another important consideration is the heterogeneity among the included studies. Variations were observed in intervention protocols, including frequency, duration, and combination with other exercise modalities. Differences in outcome measures and participant characteristics further contribute to this heterogeneity. Such variability limits direct comparison across studies and precludes quantitative meta-analysis. Similar concerns have been reported in previous systematic reviews on exercise interventions for neck pain, where heterogeneity remains a significant methodological challenge.<sup>12,18</sup> These findings are consistent with previous systematic reviews that reported beneficial effects of exercise-based interventions on neck pain and postural alignment, although no single intervention was identified as clearly superior.<sup>12,18</sup>

When compared with other exercise-based interventions, McKenzie Cervical Exercise appears to provide comparable benefits rather than clear superiority. Two studies included in this review reported similar outcomes between McKenzie and alternative exercise approaches, suggesting that while McKenzie is effective, it may not be uniquely superior. This finding aligns with broader evidence indicating that multiple forms of therapeutic exercise can be beneficial for neck pain, depending on patient-specific factors.<sup>1,18</sup> Therefore, clinical decision-making should consider individual patient characteristics, preferences, and specific functional limitations.

From a physiological perspective, the effectiveness of McKenzie Cervical Exercise may be explained by its influence on both mechanical and neurophysiological mechanisms. Repeated movements may improve joint mobility and reduce soft tissue stiffness, while also stimulating mechanoreceptors that modulate pain perception through central pathways. This dual mechanism supports both immediate symptom relief and longer-term functional improvement. However, the extent to which these mechanisms contribute to sustained outcomes requires further investigation. These mechanisms are supported by evidence indicating that therapeutic exercise can modulate pain through both peripheral and central pathways, including improved proprioception, reduced nociceptive input, and enhanced neuromuscular control.<sup>12,18</sup>

This review has several limitations that should be acknowledged. First, the inclusion of studies with varying methodological quality introduces potential bias. Second, the absence of a formal meta-analysis limits the ability to quantify effect sizes. Third, inconsistencies in outcome reporting reduce comparability across studies. Additionally, the lack of long-term follow-up in many studies restricts conclusions regarding the durability of treatment effects.

Despite these limitations, this review provides important clinical implications. McKenzie Cervical Exercise can be considered a practical, low-cost, and non-invasive intervention for managing neck pain associated with FHP. Its emphasis on self-management also enhances patient engagement and adherence. However, clinicians should apply this intervention within a broader, individualized treatment plan that considers patient-specific needs and evidence quality. Another limitation is the lack of consistent reporting of effect sizes and confidence intervals across studies, which restricts the ability to determine the magnitude and clinical relevance of the observed effects.

From a clinical perspective, McKenzie Cervical Exercise can be applied as a structured intervention involving repeated cervical movements performed regularly, typically in short sessions conducted multiple times per day. It is particularly relevant for individuals with postural-related neck pain, such as office workers and individuals with prolonged device use. The intervention may be integrated with other physiotherapy approaches depending on patient-specific conditions and functional limitations.

Future research should focus on high-quality randomized controlled trials with standardized intervention protocols, consistent outcome measures, and longer follow-up periods. Additionally, studies comparing McKenzie Cervical Exercise with other evidence-based interventions would provide valuable insights into its relative effectiveness.

## Conclusion

This systematic review indicates that McKenzie Cervical Exercise is associated with reductions in neck pain and improvements in cervical function and postural alignment among individuals with Forward Head Posture. These findings support its use as a practical and non-invasive physiotherapy intervention, particularly for managing posture-related neck pain. However, the overall strength of evidence remains moderate due to variability in study design, methodological limitations, and inconsistency in outcome reporting across studies.

Therefore, the findings should be interpreted with caution. In clinical practice, McKenzie Cervical Exercise may be implemented as part of an individualized rehabilitation program, particularly for populations exposed to prolonged static postures such as office workers and frequent device users. Future research should focus on high-quality randomized controlled trials with standardized intervention protocols, consistent outcome measures, and long-term follow-up to strengthen the evidence base and clarify its comparative effectiveness.

## Author Contribution

Nur Hamida: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing original draft.  
Rizky Wulandari: Data curation, Investigation, Validation, Visualization, Writing review and editing.  
Lailatuz Zaidah: Conceptualization, Methodology, Supervision, Validation, Writing review and editing.

## Acknowledgments

The authors would like to acknowledge all researchers whose studies were included in this review.

## Conflict of Interest Statement

The authors declare no conflict of interest.

## Funding Sources

This study received no external funding.

## Ethics Statement

This study was based exclusively on previously published data; therefore, ethical approval was not required.

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