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Effectiveness of Therapeutic Exercises in Reducing Neck Pain and Correcting Forward Head Posture in Adults: A Systematic Review

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Abstract

Objective: Neck pain is a prevalent condition that can significantly affect quality of life. The advent of various therapeutic modalities, including exercise interventions, has been explored for their efficacy in alleviating neck pain and improving posture. This systematic review aims to evaluate the effectiveness of different therapeutic exercises on neck pain and forward head posture in adults.

Material and methods: A comprehensive literature search was conducted across multiple databases, including google scholar, DBpia, Riss, NDSL and PubMed, to identify relevant studies published from June to July 2024. Inclusion criteria encompassed randomized controlled trials and observational studies focusing on adult populations experiencing neck pain. The primary outcomes assessed were pain intensity, neck function, and postural alignment. Data were extracted using standardized forms, and the quality of the included studies was evaluated using the Cochrane risk-of-bias tool.

Results: A total of seven studies met the inclusion criteria, involving a diverse range of therapeutic exercises, including scapular stabilization, McKenzie exercises, and dynamic taping techniques. The review found that exercise interventions significantly reduced pain levels and improved neck function compared to control groups. Additionally, several studies indicated favorable changes in postural alignment, particularly concerning forward head posture.

Conclusions: Therapeutic exercises demonstrate a positive impact on alleviating neck pain and enhancing postural alignment in adults. Further research is warranted to establish optimal exercise protocols and investigate long-term outcomes.

Key words: neck pain, therapeutic exercises, forward head posture, postural correction

Introduction

In modern society, the rapid advancement of digital media technology has significantly transformed people's lives and daily activities. One major consequence of this transformation is the increased prevalence of poor posture, particularly due to the widespread use of smartphones and computers, which has led to a surge in musculoskeletal issues, including neck and shoulder pain [1]. A common postural deviation associated with these technologies is the forward head posture (FHP), characterized by excessive forward positioning of the head during computer use [2,3]. This position results in structural changes where the upper cervical vertebrae are extended, while the lower cervical vertebrae and spine are flexed forward, ultimately contributing to FHP [1].

Prolonged maintenance of FHP alters the alignment of the neck and the position of the scapulae, often leading to neck pain [4,5]. Forward head posture is defined as a condition where the head is positioned anteriorly relative to the vertical axis of the body [6]. It can be objectively assessed by measuring the craniovertebral angle, with smaller angles indicating more pronounced FHP [7]. Neumann [8] demonstrated that sustained forward head positioning increases tension in the upper cervical muscles while weakening the deep cervical flexors and dorsal extensors, which leads to a loss of normal cervical alignment. Chronic muscle tension and strain in the neck area further increase the load on the muscles and joints of the cervical spine[9,10,11]. This muscular imbalance contributes to stress, muscle tightness in the neck and shoulder regions, and alterations in scapular positioning,

often leading to neck pain and various neurological symptoms [12,13,14]. Studies have shown that FHP is a major contributor to neck pain, with approximately 60% of individuals suffering from neck pain exhibiting this posture [15,16]. Given its high prevalence and associated discomfort, addressing FHP is crucial in managing neck pain.

Physical therapy interventions for FHP aim to alleviate these complex symptoms and restore proper posture. Conservative treatments such as electrical stimulation and traction therapy, along with various exercise programs, are widely employed [17]. Exercise programs such as McKenzie exercises, stabilization exercises, and specific postural correction routines have been shown to be beneficial [18,19,20,21]. Research on these interventions includes studies like Jung's [22] investigation of McKenzie exercises on functional recovery in chronic neck pain patients, Lee et al. [23] work on the effects of functional abdominal massage on head posture and pain, and Kim [24] research on cervical and thoracic joint mobilization combined with corrective exercises for FHP.

Given the rising incidence of FHP in modern industrialized and information-based societies, there is a growing need for ongoing research into effective treatment strategies for this condition [25,26]. The purpose of this study is not to conduct new experimental research but to perform a systematic review of existing evidence on the efficacy of various physical therapy interventions aimed at reducing neck pain in individuals with FHP. This review aims to synthesize current findings and provide a comprehensive understanding of the most effective approaches for managing neck pain associated with FHP.

Material and methods

Data Collection

A literature search was conducted from June 1 to June 8, 2024, using a personal laptop to access databases such as Google Scholar, DBpia, Riss, NDSL, and PubMed. The search focused on articles published between 2000 and 2022, a period marked by the rapid increase in computer and smartphone usage, which has been associated with the development of FHP.

Search terms included combinations of “forward head posture,” “anterior head posture,” “turtleneck syndrome,” and “neck pain.” These terms were applied across the selected databases: Google Scholar, DBpia, PubMed, Riss, and NDSL. Relevant studies were identified by reviewing titles and abstracts, selecting articles that investigated various interventions for neck pain related to forward head posture. Studies that did not present exercise interventions or lacked accessible full-text versions were excluded. Initially, over 100 articles aligned with the research topic were identified. From this pool, the selection was narrowed to 29 papers, and ultimately, 7 studies were chosen as the most relevant to the investigation. These 7 studies were selected based on their focus on physical therapy interventions for neck pain associated with FHP.

Analysis Method

A total of 29 articles were categorized from over 700 articles published between 2000 and 2022 across the five databases (Google Scholar, DBpia, PubMed, Riss, and NDSL) based on the specified search terms and strategy. From this group, 7 randomized controlled trials (RCTs) that best met the study's criteria were selected for detailed analysis. These trials examined the effectiveness of interventions aimed at reducing neck pain caused by forward head posture (see Figure 1).

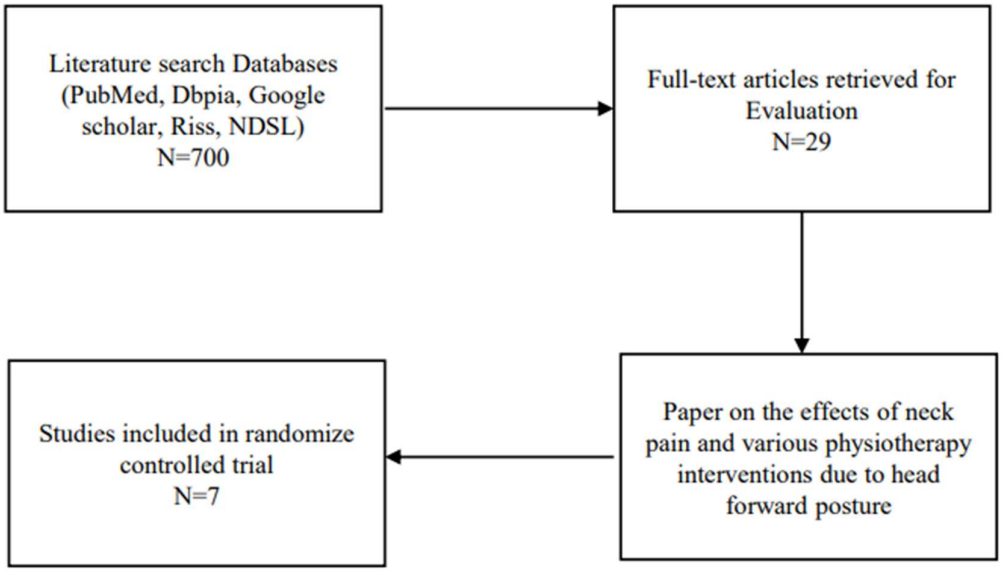

Figure 1. Study Selection Process

Results

General Characteristics of the Selected Studies

All the studies included in this review involved interventions aimed at addressing FHP in relation to neck pain. Out of the 29 articles initially identified, seven were selected for detailed analysis. The publication years of these studies were: one article in 2006, one in 2014, one in 2018, one in 2019, and three articles in 2020.

Analysis of the Content of Previous Studies

The selected studies, as outlined in Table 1, analyzed various interventions targeting forward head posture using neck pain as a primary variable. In an experimental study by Yoon [26], eight individuals were assigned to a neck exercise group, another eight to a shoulder combination exercise group, and eight to a control group. The purpose was to evaluate the effects of regular posture training, neck exercises, and shoulder combination exercises on neck pain in men diagnosed with forward head posture. The study found that neck exercises were most effective for patients with neck pain caused by FHP, and the addition of shoulder exercises led to positive changes in cervical functional disability and neck tilt angle. Kim [24] investigated 16 patients with forward head posture and neck pain. The study aimed to evaluate the effects of cervical and thoracic joint mobilization combined with corrective exercises on head posture and the neck disability index. Corrective exercises included cervical spine alignment and thoracic kyphosis reduction exercises. The group that received corrective exercises following thoracic joint mobilization showed more significant improvements in head and neck perception, neck pain, and disability compared to the group that received corrective exercises after neck joint mobilization.

Park et al. [27] in their study included 30 individuals with FHP and divided into two groups: one receiving TECAR treatment combined with corrective exercises, and the other receiving only corrective exercises. The results showed that both groups experienced significant improvements in head-spine alignment and reductions in neck pain and neck disability index, with the experimental group showing more significant improvement. Measurement methods used included neck angle, algometer, visual analog scale, and the neck disability index. Jeong [22] conducted a study on university students with chronic neck pain, comparing the effects of therapeutic massage followed by McKenzie exercises. The results demonstrated significant reductions in neck pain, as assessed by the VAS and NDI, two weeks after treatment. Kim and Park [28] randomized 30 college students with FHP into three groups to compare horseback riding simulator exercises, sling exercises, and Kendall exercises. All three groups showed significant improvements in neck pain and head-spine perception, with no significant differences between the groups.

Cha [29] divided 30 young adults with FHP into a neck and shoulder stabilization group and a head-neck flexion exercise group. Both groups showed significant reductions in neck pain and improvements in neck

function, cranio-vertebral angle, and cranio-rotation angle, with no notable differences between the groups. Park et al. [30] studied 34 patients with neck pain and FHP, comparing a combined exercise program with and without dynamic taping. The results indicated that both groups experienced significant improvements in neck pain and dysfunction, with the experimental group, which included dynamic taping, showing more significant improvements. Assessment methods used included the VAS and NDI to evaluate the differences between the groups before and after intervention.

Table 1. Characteristics of included studies

Authors	Participants (age)	Study Design	Interventions		Results
			Experiment	Control	
Se-Hee Yoon (2014) [26]	N = 16 (20-30)	Randomized controlled trial	Cervical exercise, postural training, shoulder complex exercise	Cervical exercise, postural training	The experimental group showed significant improvement in pain compared to the control group
Yongmin Kim (2019) [24]	N = 16 (20-45)	Randomized controlled trial	Cervical and thoracic joint mobilization, + corrective exercise	Cervical joint mobilization, + corrective exercise	Both groups showed decreased in pain and increase in CVA. However, no difference between groups were observed
Park et al. (2018) [27]	N = 30 (20-40)	Randomized controlled trial	TECAR Treatment + corrective exercise	Corrective exercise	Both groups showed a reduction in pain with the experimental group showing more pain reduction compared to the control group
Yeonwoo Jeong (2006) [22]	N= 45 (18 35)	Randomized controlled trial	Therapeutic Massage 15 min + McKenzie exercise	Therapeutic Massage	Improvements were observed in CRA, VAS and CVA only in the experimental group
Kim & Park (2020) [28]	N = 30 (20-30)	Three-group pretest-posttest design, RCT	Group I: Horseback riding simulator exercise.	Group II: Sling exercise. Group III: Kendall exercise.	All groups showed a statistically significant decrease in pain and increase in CVA
Juhong Cha (2017) [29]	N = 30 (20-30)	Randomized controlled trial	head-neck, shoulder stabilization exercise with Theraband	head-neck, shoulder stabilization exercise without Theraband	CVA, CRA, and pain significantly improved in both groups with the experiment group superior to the control group
Park & Jung (2022) [30]	N = 34 (20-40)	Randomized controlled trial	Scapular stabilization, lower trapezius strengthening exercise + upper trapezius dynamic taping	Scapular stabilization and lower trapezius strengthening exercise	Both groups showed a significant decrease in VAS and NDI. The experimental group showed great effects on NDI compared to the control group.

RCT: Randomized controlled trial; VAS: Visual analog scale; NDI: Neck disability index; CVA: Craniovertebral angle; CRA: Cranial rotation angle

Discussion

With the increasing use of computers and smartphones in modern society, musculoskeletal problems in the neck and shoulders are becoming more prevalent [31], and these issues are known contributors to FHP [3]. Neck pain, in particular, is an escalating concern among individuals who frequently use digital devices [32]. This paper reviewed seven studies that explored various interventions for people with neck pain and forward head posture. The findings indicated that these interventions were effective in reducing both symptoms, demonstrating that exercise interventions can be performed safely without significant side effects.

According to Taimela et al. [33], cervical and thoracic stabilization exercises resulted in significant improvements in chronic neck pain when compared to a control group. The addition of shoulder exercises, rather than focusing solely on neck movements and posture correction, led to improvements in the neck disability index and neck inclination angle. These results underscore the value of incorporating shoulder exercises alongside neck stabilization techniques. Hyun [34] found that joint mobilization led to a significant reduction in neck pain over a four-week period, compared to a control group. Furthermore, Jun et al. [35] reported that upper thoracic joint mobilization was more effective than cervical joint mobilization in reducing neck pain, improving craniovertebral angle, and decreasing the neck disability index. This suggests that targeting the thoracic spine might offer greater benefits for patients with chronic neck pain.

In the other hand, Wi [36] demonstrated that TECAR therapy increased the pain threshold, providing an analgesic effect. Similarly, Im et al. [37] reported that scapular stabilization training in combination with TECAR therapy significantly improved both neck pain and posture alignment. These findings indicate that the combination of corrective exercises and TECAR therapy can be particularly effective in reducing forward head posture and related pain. Hong et al. [38] explored the impact of equestrian simulator exercises on cervical alignment in adults with FHP, finding that these exercises improved cervical angles and reduced pain. Hurman et al. [6] also demonstrated that 10 weeks of exercise improved neck alignment, while Jang [39] showed that six weeks of sling exercises reduced neck pain and enhanced cervical alignment. These results are consistent with those found in this study, highlighting the effectiveness of such exercises in reducing pain and correcting posture.

Anderson et al. [40] divided 198 patients with neck pain into an experimental group and a control group, using elastic bands and strengthening exercises. Their findings showed significant improvements in the Neck Disability Index among the exercise group. Likewise, Yoon and Kim [41] found that dynamic taping and scapular stabilization exercises significantly reduced chronic neck pain. In addition, Kim et al. [42] demonstrated that McKenzie exercises were effective in reducing pain over a four-week period.

While the reviewed studies collectively show that various interventions are effective in addressing neck pain and forward head posture, several limitations should be noted. One key limitation is the small sample sizes used in many of the studies, which restricts the generalizability of the findings. Larger, more diverse participant groups are needed to strengthen the evidence. Additionally, the short duration of these interventions, ranging from four to ten weeks—makes it difficult to assess the long-term efficacy of these treatments. Future studies should consider longer follow-up periods to determine the sustainability of the results. There was also a significant variation in the types of interventions studied, making direct comparisons challenging. The absence of control groups in some studies raises concerns about whether the observed improvements can be solely attributed to the interventions or influenced by other factors. Furthermore, many of the studies relied on self-reported outcomes, such as the Neck Disability Index, which may introduce bias due to the subjective nature of the measurements. In conclusion, while the interventions reviewed provide promising results in reducing neck pain and improving forward head posture, future research should address these limitations by including larger sample sizes, longer follow-up periods, more consistent methodologies, and objective outcome measures..

Conclusions

The purpose of this study was to provide evidence for the clinical treatment of forward head posture by examining research that investigates its relationship with neck pain. In conclusion, this study underscores the effectiveness of various interventions in addressing neck pain and forward head posture, which have become increasingly prevalent issues due to the widespread use of computers and smartphones. The reviewed interventions—cervical and thoracic stabilization exercises, joint mobilization, TECAR therapy, scapular stabilization training, and McKenzie exercises—consistently demonstrated improvements in reducing neck pain and correcting postural misalignments. These findings suggest that a combination of exercise-based treatments can be safely and effectively implemented to manage neck pain and forward head posture in modern populations. Future research should focus on larger sample sizes and longer intervention durations to further validate these findings and explore the long-term effects of these interventions.

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Conflict of interest

The authors declare that there is no conflict of interest.

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