

Influence of physiotherapy on forward head posture and related problems – a critical review of literature

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Abstract

Forward head posture (FHP) is frequently observed in both patients and the asymptomatic population. FHP is defined as a position in which the external auditory canal is forward to the plumb line that goes through the shoulder. The reasons for these changes can vary, but one contributing factor may be the increased use of modern technology such as smartphones, laptops, and tablets. Studies have shown that individuals using smartphones for more than 4 hours per day are more likely to exhibit FHP and experience neck pain more frequently. A forward head position is associated with lower cervical spine flexion and upper cervical spine extension. The craniovertebral angle (CVA) is commonly used to quantify the degree of FHP. Existing evidence suggests that manual therapy has the potential to influence pain and disability in patients, prompting the research focus on postural changes. Providing patients with information about the possibility of postural corrections through physiotherapy is deemed valuable. A total of six papers were critically reviewed, comprising five randomized controlled trials and one systematic review. In summary, all studies indicate the potential influence of physiotherapy on forward head posture as measured by the craniovertebral angle. Manual therapy appears to be beneficial in the short term, and exercises are deemed necessary to achieve lasting effects of the treatment. The findings suggest that it is indeed possible to influence forward head posture through physiotherapy management.

Key words

exercise, forward head posture, cranio-vertebral angle, manual therapy.

Introduction

Forward head posture (FHP) is frequently observed in both patients and the asymptomatic population. FHP is defined as a position in which the external auditory canal is forward to the plumb line that passes through the shoulder [1]. The reasons for these changes can vary, but one contributing factor could be the increased use of modern technology, including smartphones, laptops, and tablets [2].

Research has shown that individuals using smartphones for more than 4 hours per day exhibit higher instances of FHP [3] and are more prone to experiencing neck pain [4]. A forward head position is associated with lower cervical spine flexion and upper cervical spine extension. The Craniovertebral angle (CVA) is commonly used to quantify the degree of FHP [5]. The CVA is an angle formed between two lines: one extending from the end of the C7 spinous process to the tragus, and the other being a horizontal line. When the CVA is less than 50°, the head is in a more forward position, considered a pathological stance [6].

In clinical settings, there has been a noticeable increase in the number of patients expressing interest in correcting FHP. Interestingly, a growing proportion of these individuals do not experience neck pain but are motivated by a desire to "look better." This trend prompts an investigation into the potential for achieving lasting improvements in posture positions in adults.

Aims

The purpose of this study was to assess the effect of Orthopaedic Manual Physical Therapy (OMPT) on head and neck posture in individuals without symptoms and those with neck pain and disability.

Material and methods

Search strategy

In December 2023, the following literature search strategy was performed using PICO (population, intervention, control, outcomes) terms as a guide: (1) Patient group: Adults with forward head posture; (2) Intervention: OMPT treatment; (3) Comparison:

Before and after intervention; (4) Outcome: Forward head posture, Craniovertebral Angle, neck pain. The search was conducted within the following databases: PubMed/Medline, EMBASE/Science Direct, and Cochrane databases. Free language terms related to the topic were employed, and Boolean operators "OR" and "AND" were utilized during the search.

Inclusion and exclusion criteria

Inclusion Criteria: Forward head posture measured, adult males and females, treatment procedures (manual techniques, exercises, education), systematic reviews, meta-analyses, randomized controlled trials. Papers must be in English and not older than 5 years, with only abstracts available.

Exclusion Criteria: Children, patients after accidents or injuries, patients after surgical treatment, and publications older than 5 years. Further selection involved studying the titles and abstracts before including the studies. The following Boolean operations were used in searching for the articles:

PubMed/MEDLINE

"forward head posture" 57 results

"forward head posture" AND "manual therapy" 18 results

"forward head posture" AND "neck pain" 49 results

"forward head posture" AND ("manual therapy" AND "neck pain") 6 results

"craniovertebral angle" OR "forward head posture" AND "manual therapy" 16 results

EMBASE/Science Direct

"forward head posture" 54 results

"forward head posture" AND "manual therapy" 19 results

"forward head posture" AND "neck pain" 53 results

"forward head posture" AND ("manual therapy" AND "neck pain") 8 results

"craniovertebral angle" OR "forward head posture" AND "manual therapy" 18 results

Cochrane

“forward head posture” 0 results

“posture” AND “manual therapy” 0 results

Results

In the searching process, 298 articles were analyzed. 292 studies that did not meet the inclusion criteria were excluded. Six articles met the criteria and were included in the study. Five articles were clinical trials, and one was a systematic review. The characteristics of the studies are summarized in **Table 1**.

Clinical results from analyzed studies

Cho et al., 2019 [7], aimed to compare the effectiveness of joint mobilization techniques performed on the cervical and thoracic spine versus exercises for deep neck flexors in individuals with FHP. Participants were randomized into two groups. Group one received a 10-minute mobilization treatment on C1-2 and T1-2 to improve neck flexion, while group two underwent cervical spine stabilization exercises [8]. The CVA, numeric pain rating scale (NPRS), respiratory function, and global rating of change (GRC) score were assessed before treatment, after 4 weeks of treatment, and after a 4-week follow-up. According to the authors, participants who underwent mobilization procedures had significantly better short-term outcomes compared to the exercise group.

In Kim et al., 2021 [9], the authors aimed to investigate the influence of a 4-week sling-based manual therapy performed in the area of the cervicothoracic junction (CTJ) on pain (NPRS), forward head posture (CVA), and neck function assessed through range of motion assessment and the Neck Disability Index (NDI). Measurements were taken before and after 4 weeks of treatment, with no follow-up. The control group received joint mobilization and motor control training for the upper cervical spine, while the CTJ treatment group underwent the same treatment for the upper cervical spine and cervicothoracic junction in the area from C7 to T3. The final assessment showed a significant im-

provement in CVA and neck extension in the CTJ treatment group.

In Mylonas et al., 2021 [10], the authors aimed to assess the short-term effects of soft tissue (instrument assisted soft tissue mobilization, IASTM) mobilization techniques and exercises on patient pain levels and posture. Twenty FHP patients with neck pain were divided into two groups: one group had 8 sessions of soft tissue mobilization and exercises, while the control group received classical massage and the same exercises. They measured CVA, cervical range of motion (ROM), pain (visual analogue scale, VAS), and neck disability index (NDI) during treatment, as well as 2 and 4 weeks after. The treatment group showed improvement in posture position, with better CVA and NDI questionnaire scores compared to the control group. There was no difference in other parameters.

In Aneis et al., 2022 [11], the goal of the study was to examine the effectiveness of treatment for patients with upper crossed syndrome (UCS). The 4-week treatment consisted of muscle energy techniques (MET), cervical and scapulothoracic stabilization exercises, and postural correction training with ergonomic advice. Forty patients were divided into intervention and control groups. The initial assessment covered the craniovertebral angle, pain intensity using the VAS, and functional disability evaluated using the Arabic version of the neck disability index (ANDI). Patients were reassessed 4 weeks after the intervention. Participants in the intervention group demonstrated a decrease in VAS and ANDI and an increase in CVA. The authors concluded that the 4-week multimodal approach improved CVA, pain intensity, and functional disability in patients with UCS.

In Titcomb et al., 2023 [12], the authors aimed to compare the influence of different physiotherapy approaches on young adults with FHP. The CVA was assessed in all participants before and after 4 weeks of treatment procedures. The compared physiotherapy interventions were postural education (PE) and two corrective exercise programs (CEPs). Seventy-nine participants were rand-

omized into four groups: postural education group (PE), self-myofascial release and stretching group (SMRS), self-myofascial release and stretching and strengthening group (SMRSS), and the control group (CG). The authors concluded that CEPs may provide better effects than PE alone. Importantly, the 4-week program of self-myofascial release and stretching produced similar results to self-myofascial release and stretching combined with strengthening. The main improvement observed was a better outcome in CVA measurements.

Chaudhuri et al. [13] in 2023 conducted a systematic review on different interventions for the treatment of upper cross syndrome with the aim of identifying effective strategies for posture correction. The inclusion criteria encompassed prospective studies, clinical trials involving humans, conducted in English, and reporting on the assessment and treatment of upper cross syndrome. Variables such as Craniovertebral angle, kyphotic angle, neck or shoulder pain, neck range of motion, electromyographic activity of neck or scapular muscles, and functional limitations were assessed. To evaluate the methodological quality of randomized controlled trials, the Cochrane collaboration tool was employed, while the Risk of Bias in Non-randomized Studies of Intervention protocol was used for non-randomized studies. The Grading of Recommendations, Assessment, Development, and Evaluation system was utilized to rate the effectiveness of the evidence. The results indicated that postural variables improved with the physiotherapy group compared to the non-treatment group. Additionally, advanced manual therapy techniques demonstrated a significant difference in outcomes like pain and functional limitations compared to conventional therapy. Exercise physiotherapy was found to be more effective in correcting postural alignment and movement patterns, whereas pain reduction and improvements in functional limitations were more pronounced with manual therapy.

Evidence status

Quality of evidence was rated with the PEDro Scale: The paper by Cho et al., 2018 [7], received a rating of

7/10 on the PEDro Scale. The absence of concealed allocation to the groups and the lack of blinding for both subjects and therapists pose concerns in this type of research.

The paper by Kim et al., 2021 [9], earned a score of 8/10 on the PEDro Scale. The authors did not implement blinding for both subjects and therapists.

Mylonas et al., 2021 [10], it was rated 6/10 on the PEDro Scale. The study lacked concealed allocation to the groups, and subjects and therapists were not blinded. Additionally, an intention-to-treat analysis was not performed.

The paper by Aneis et al., 2022 [11], received a PEDro Scale rating of 8/10. Similar to the study by Kim et al. [9], the authors did not implement blinding for both subjects and therapists.

The paper prepared by Titcomb et al., 2023 [12], was not rated by PEDro. One reason could be that it is a recently published article. Applying the PEDro Scale to the manuscript, I would rate it 8/10. The eligibility criteria were specified, subjects were randomly allocated to groups, allocation to the groups was concealed, groups were similar at baseline, the authors did not blind the subjects and did not blind the therapist, key measures were obtained from over 90% of the subjects initially allocated to groups, intention-to-treat analysis was performed, there was statistical analysis of the group's results, and the study provided both point measures and measures of variability for the key outcome.

The paper by Chaudhuri et al., 2023 [13], is a systematic review and meta-analysis, so it was not rated with the PEDro scale. The Criteria Used in Quality Assessment of Systematic Reviews were employed to assess this article [14], and it received a score of 10/12. The methodology was deemed rather correct. However, the conclusions drawn in this review, specifically points 9 and 12 of the Criteria Used in Quality Assessment, could be debatable. According to the authors themselves, the findings were based on low to poor-quality evidence.

Table 1. The characteristics of the relevant studies (based on Levels of Evidence, Centre for Evidence Based Medicine, 2011).

Authors, year	Study design	Population	Intervention investigated	Comparison intervention	Outcomes used	Findings
Cho et al., 2018 [7]	Randomized clinical trial	Adult patients with FHP, females, males	4 weeks upper cervical and thoracic mobilization	4 weeks deep cervical flexors exercises	Craniovertebral angle, pain level, respiratory function, global rating of change	The combination of upper cervical and upper thoracic spine mobilization indicated better overall short-term outcomes in CVA, NPRS, respiratory function, and GRC compared with DCFE in individuals with FHP
Kim et al., 2021 [9]	Single blind randomized controlled trial	Adult patients with FHP, females, males	4 weeks upper cervical spine and cervicothoracic junction mobilization and motor control training	4 weeks upper cervical spine mobilization and motor control training	Pain level, NDI, craniocervical angle, active ROM of cervical spine, muscle activity	Intervention group showed improvement in the CVA and extension range. Both improved in pain level and NDI questionnaire.
Mylonas et al., 2021 [10]	Randomized control study	Adult patients with FHP, females, males	8 sessions targeted IASTM in combination with neuromuscular exercises	8 sessions of classical massage and the same set of exercises	The cervical vertebral angle, cervical range of motion and strength, pain (VAS), and neck disability index (NDI) were measured in the treatment period and in the two- and four-week post-treatment periods	Application of IASTM and neuromuscular exercises improved CVA more than massage. Both interventions improved cervical ROM and strength in the short term. Pain was also significantly improved in both groups in both the short and intermediate term

<p>Aneis et al., 2022 [11]</p>	<p>Randomized controlled trial</p>	<p>Adult patients with FHP, females, males</p>	<p>4 weeks multimodal approach: muscle energy technique (MET), cervical and scapulothoracic stabilization exercises, and postural correction training with ergonomic advice</p>	<p>4 weeks muscle energy technique only</p>	<p>CVA, sagittal shoulder angle (SSA), VAS, functional disability: Arabic version of the neck disability index (ANDI) pretreatment and four weeks after intervention</p>	<p>Decrease in VAS and ANDI and an increase in CVA in intervention group.</p>
<p>Titcomb et al., 2023 [12]</p>	<p>Randomized control trial</p>	<p>Adult healthy with FHP, females, males</p>	<p>4 weeks treatment: postural education group (PE), and two corrective exercise programs (CEPs) self-myofascial release and stretching group (SMRS), self-myofascial release and stretching and strengthening group (SMRSS)</p>	<p>Control group not received an intervention and was asked not to begin a new exercise program or alter their current physical activity level over the next four weeks</p>	<p>Participant CVA was assessed before and after a 4-week intervention</p>	<p>All three interventions appear to be effective techniques for improving FHP in young adults, however CEPs may provide superior outcomes than PE alone. A 4-week CEP consisting of self-myofascial release and stretching gave similar CVA improvements as a CEP consisting of self-myofascial release, stretching and strengthening.</p>
<p>Chaudhuri et al., 2023 [13]</p>	<p>systematic review and meta-analysis</p>	<p>Adult patients with upper crossed syndrome, females, males</p>	<p>Exercise therapy, electrotherapy, manual therapy, home exercise program, and ergonomic advice, manual therapy techniques, myofascial release, massage, active release, and muscle energy techniques</p>	<p>Effectiveness of different physiotherapy manual techniques to each other or to another control other treatment or no treatment group</p>	<p>The studies were included if they measured forward head position or craniovertebral angle, kyphotic angle, shoulder angle, pain due to upper cross syndrome, functional limitation of the neck, cervical ROM, and electromyographic activity of the scapular/neck/shoulder.</p>	<p>The postural variables including craniovertebral angle, kyphotic angle, and rounded shoulder showed a significant improvement with the physiotherapy group compared to the no-treatment group. Secondary outcomes such as pain and functional limitation showed a significant difference when advanced manual therapy techniques were used compared to conventional therapy</p>

Discussion

FHP is a common cervical postural disorder in the sagittal plane, observed in both patients and the asymptomatic population. The association with neck or head pain is controversial, but an increasing number of patients, particularly younger individuals, are seeking the possibility of postural correction.

According to the OMPT definition, modern manual therapy encompasses almost all possible physiotherapeutic interventions, including manual techniques, exercises, and education. This paper analyzes scientific areas that cover the treatment of subjects with FHP, measuring the CVA before and after treatment.

Various factors can cause incorrect shapes of muscular and skeletal structures, commonly including abnormal postures due to reduced physical activity or inappropriate postural habits, such as prolonged use of smartphones and computers. The COVID-19 pandemic has exacerbated this issue, leading to increased online activities and prolonged periods of sitting in ergonomically incorrect postures, resulting in various health issues.

Postural problems, including FHP, can even occur in healthy or asymptomatic individuals. FHP is characterized by the excessive anterior positioning of the head in relation to the vertical reference line. The cervical spine is primarily stabilized by the deep neck flexor and neck extensor muscles, which weaken when in an elongated position [15]. FHP is more commonly observed in people with other abnormal postural conditions like scoliosis [16].

Additionally, it has been observed that the increasing use of electronic devices, such as smartphones and computers for more than 8 hours per day, raises the likelihood of having FHP [17]. Of interest, lower CVA and larger FHP are associated with reduced cervical range of motion, especially in flexion and rotation, along with other problems like an increased risk of headaches or balance disturbances [18-20].

Is it possible to have lasting influence on head and neck posture with physiotherapy treatment? Could we also influence neck pain and disability in patients with increased forward head position? These questions I will try to answer.

In the present critical appraisal, six articles were finally analyzed, comprising five clinical trials and one systematic review. Cho et al. 2018 [7] conducted a randomized clinical trial where adult patients underwent a 4-week treatment program. The authors compared joint mobilization to cervical deep flexor exercises and concluded that the mobilization group exhibited better overall short-term outcomes in CVA, NPRS, and other outcomes compared with deep neck flexor exercises in individuals with FHP. While consistent with previous studies [21] in this topic, Cho et al. 2018 was the first to assess the influence of manual treatment on postural changes with CVA measurement. The study's limitations included a small sample size (15 participants in each group) and a short follow-up period of only 6 weeks after finishing treatment. The results should not be generalized to people with just FHP or patients with neck pain from FHP. Despite the sample size being calculated based on a previous study, the lack of a control group makes it challenging to identify natural changes over time and the placebo effect. Future studies should consider a longer follow-up and a larger sample size with a multicenter randomized clinical trial design.

Kim et al. 2021 [9] investigated the effects of sling-based manual therapy on specific vertebral segments in patients with neck pain and forward head posture. The results indicated that the group which received manual therapy treatment at the cervicothoracic junction showed improvements in forward head posture angle and cervical extension range of motion compared to the group that had manual therapy at the upper cervical spine. This finding aligns logically with clinical perspectives and is consistent with previously described results [22,23].

Previous authors have reported improvements in cervical range of motion, especially extension and rotation, and the forward head posture angle when mobilization techniques were performed on patients' upper thoracic spine compared to the group that only had upper cervical spine mobilization. In this study, both groups received the same upper cervical intervention, with the treatment group additionally receiving cervicothoracic junction treatment. The authors' conclusion that this could indicate a biomechanical rather than a neurophysiological effect seems somewhat superficial. There are studies describing neurophysiological effects following manipulation and mobilization of the cervical and thoracic spine [21,24].

The main conclusion that manual therapy on the upper thoracic spine had better results for neck pain and posture than mobilization for the upper cervical spine could be useful since upper neck symptoms are common in FHP patients, and patients often seek treatment for the location of their symptoms. The study's limitations included the age of the participants, who were between 18 and 45 years old, making it challenging to draw general conclusions for older populations. The study was limited to chronic patients, and there was no final follow-up procedure described.

Mylonas et al. (2021) [10] assessed the influence of soft tissue mobilization techniques with tools (IASTM) on FHP, range of motion, and strength, comparing it to classical massage. The authors noted that both interventions reduced patients' pain, and this effect persisted without a significant difference between groups in the 4-week follow-up. These effects align with well-known outcomes associated with various myofascial release programs that contribute to pain reduction [25,26]. While the improvement in FHP may be correlated with pain reduction, it remains unclear whether pain reduction influences FHP or vice versa. In the final results, the authors stated that FHP improvement was better in the IASTM group, but the reasons for this were not clearly elucidated. It is suggested that the input may have been stronger with

IASTM, but unfortunately, the intensity of the input was not described. An interesting limitation of the study was the lack of homogeneity or reference to the pathology that led to cervical pain, a crucial aspect given the potential variability in the reasons for FHP and neck pain. The authors' conclusion that manual techniques could be beneficial for FHP and neck pain patients is in agreement with other studies in this field.

Anei et al., 2022 [11], compared the effects of multiple treatments on CVA, pain levels, and other outcomes with muscle energy techniques alone. While it seemed obvious which group would have better results, both groups demonstrated improvements in CVA and pain levels, with not much difference between them. The authors concluded that the improvement in FHP, as measured by the enhancement in CVA, was achieved by restoring normal muscle balance [27]. Pain reduction also correlated with improvements in FHP.

One of the reasons for increased disability in FHP may be impaired proprioception, affecting neck muscle function in patients with a smaller CVA [5]. This suggests a potential avenue for future studies in this area. The improvement of proprioception with postural improvement seems achievable within a 4-week treatment program.

The limitations of the study included the lack of random sampling of patients, which could introduce bias in the final results due to inconsistency with the entire population, and the absence of follow-up. What stands out in this paper is the fact that multimodal interventions were not significantly better than just muscle energy techniques in improving CVA and reducing pain during the 4-week treatment program. It is possible that some procedures from the multimodal approach were not as effective. Investigating this issue further in the future would be interesting.

Titcomb et al., 2023 [12], compared three treatment protocols for improving CVA in healthy participants with FHP, including a control group. According to the authors, it is possible to increase CVA

in 4 weeks with education and exercises in young adults. Since this study was conducted on young, healthy individuals and focused on static posture, these results should not be generalized to different age groups or patients with specific medical conditions. Other limitations include the lack of blinding for researchers and no long-term follow-up.

Chaudhuri et al., 2023 [13], conducted a systematic review with a meta-analysis to understand the best physiotherapy options for upper cross syndrome, where CVA and FHP were measured as treatment outcomes. Unfortunately, according to the authors, we do not currently have good quality studies available. According to low-quality studies, exercises can affect postural imbalance, correct FHP, and influence CVA. Supervised exercises, whether online or in-person, yielded significantly better results than exercising alone without any guidance [28]. When manual therapy was included in the treatment protocols, the authors observed additional improvements in neck pain, range of motion, and functional limitations. A limitation of this review was the high to moderate risk of bias in most studies, reducing the level of reliability of these findings.

According to the studies analyzed, although the results are primarily based on evidence that is not very robust, it seems that exercise combined with manual therapy and education should positively influence FHP and increase CVA in the short to medium term (1 to 4 weeks). The long-term effects are not clear, but it can be concluded that the reason for experiencing FHP is crucial. If it is related to daily posture, work, hobbies, or smartphone use, the possibility of having a lasting effect without changing movement patterns is rather low [29].

FHP is a growing problem, with aesthetic concerns also in consideration. Commercial physiotherapy could leverage this knowledge to develop regular, periodic physiotherapy training programs for "posture maintenance" when clients need it.

Limitations of the study

There is evidence that manual therapy can influence pain and disability in patients, so the focus of the research question was on postural changes. Providing patients with answers about the possibility of postural corrections through physiotherapy seems valuable. Six papers were critically reviewed, including 5 randomized controlled trials and 1 systematic review.

However, there are a couple of limitations to this study. This critically appraised paper has not been peer-reviewed by another independent person. The quality of the assessed articles was generally low. The reasons for this varied, but it was mostly due to a short follow-up period of only 4 weeks or even a lack of follow-up. Additionally, there was no blinding of the researchers or subjects, and in the assessed systematic review, a high risk of bias was observed.

Conclusions

Considering the described limitations, we can cautiously conclude that it is possible to influence FHP with physiotherapy. Manual therapy could be beneficial in reducing pain and improving the range of motion of the head, cervical, and thoracic spine when it occurs in patients. Manual therapy might be effective in improving head position in the short term, but it seems that long-term, lasting effects are only possible with prolonged exercise, and the exact dosage has not yet been researched.

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