

Impact of a Targeted Exercise Regimen on Forward Head Posture, Pain Reduction, and Cervical Function in Healthy Adults: A Case Report

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Abstract

This study investigates the effectiveness of a tailored exercise program designed to correct Forward Head Posture (FHP) in healthy adults. FHP, marked by the anterior displacement of the head relative to the body's center of gravity, is often associated with musculoskeletal discomfort and dysfunction. The study evaluates the impact of a therapeutic exercise regimen on correcting FHP, reducing pain, and enhancing cervical muscle activation. Participants engaged in an eight-week exercise program that targeted the deep cervical flexors and cervical extensors. The results demonstrated significant improvements in FHP alignment, reduced pain levels, and enhanced cervical Range of Motion (ROM). These findings suggest that targeted therapeutic exercises can be an effective intervention for addressing FHP and its associated symptoms. Future research should include larger sample sizes and explore detailed aspects of posture and muscle activation to further validate and refine these results.

Keywords: Forward Head Posture, Therapeutic Exercises, Neck Pain, Deep Cervical Flexor Strengthening

INTRODUCTION

Forward head posture (FHP) is a prevalent postural disorder, particularly in populations engaged in prolonged sedentary activities, such as office workers, students, and individuals frequently using digital devices (Andersen et al., 2011). FHP is characterized by the anterior displacement of the head relative to the vertical axis of the body, leading to increased cervical lordosis in the lower cervical spine, a compensatory extension in the upper cervical spine, and associated shoulder protraction and thoracic kyphosis (Andersen et al., 2011; Blangsted et al., 2008).

The prevalence of FHP has been rising, especially with the increased use of computers, smartphones, and other digital devices that promote prolonged forward head positioning. According to Griegel-Morris et al. (1992), FHP is observed in approximately 66% of a young adult population, with a higher prevalence among females than males (Naz et al. 2018). Moreover, the prolonged maintenance of this posture has been linked to several musculoskeletal disorders, including chronic neck pain, shoulder pain, and upper back pain (van der Windt et al., 2000).

The biomechanical implications of FHP are significant. The forward displacement of the head places increased stress on the cervical spine, leading to adaptive shortening of the suboccipital muscles and elongation and weakening of the deep cervical flexors (Pinzón Ríos 2015). This imbalance can result in what is commonly referred to as the "upper crossed syndrome," a condition characterized by tightness in the upper trapezius and levator scapulae, and weakness in the deep neck flexors, rhomboids, and lower trapezius (Sun et al., 2014, Chang et al. 2023). Such muscular imbalances contribute to altered movement patterns, reduced range of motion (ROM), and increased risk of injury (Chaudhuri et al. 2023).

Research has demonstrated that FHP is not merely a cosmetic concern but is associated with a range of clinical symptoms. Individuals with FHP are more likely to experience headaches, temporomandibular joint disorders, and reduced pulmonary function due to altered respiratory mechanics (Koseki et al 2019). For instance, Lau et

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al. (2010) found a strong correlation between the severity of FHP and the frequency and intensity of headaches in young adults (Lee & Lee 2019). Furthermore, Hanten et al. (2000) noted that FHP is associated with reduced cervical ROM, particularly in flexion and extension, which can significantly impact an individual's functional abilities.

Given the widespread prevalence and potential health risks associated with FHP, there is a growing interest in developing effective intervention strategies. Exercise-based interventions are among the most commonly recommended treatments for FHP, focusing on strengthening the weakened muscles and stretching the tight muscles to restore proper postural alignment (Yang et al. 2023). A study by Harman et al. (2005) demonstrated that a structured exercise program could significantly improve head posture and reduce associated neck pain in office workers over an eight-week period. In addition to traditional exercise programs, more recent research has explored the use of specialized physical therapy techniques, such as proprioceptive neuromuscular facilitation (PNF) and myofascial release, to address the underlying muscle imbalances associated with FHP (Yang et al. 2023). For example, a study by Diab and Moustafa (2011) showed that combining corrective exercises with PNF techniques resulted in more significant improvements in head posture and pain reduction compared to exercise alone.

This case study aims to evaluate the effectiveness of a specific therapeutic exercise program designed to correct FHP in healthy adults. By focusing on strengthening the deep cervical flexors, stretching the cervical extensors, and improving overall posture, the study seeks to provide evidence for the clinical application of exercise-based interventions in the management of FHP. The outcomes of interest include pain intensity, cervical ROM, and postural correction, which will be measured pre- and post-intervention. Through this research, we aim to contribute to the growing body of evidence supporting the use of targeted exercise programs in the management of FHP and related musculoskeletal disorders. The findings from this study may also provide insights into optimizing treatment protocols for individuals with FHP, ultimately improving their quality of life and reducing the burden of musculoskeletal pain.

METHODS

Participants

Two subjects were selected for this case study based on specific inclusion and exclusion criteria. Both participants were otherwise healthy adults, aged 25-35 years, with a clinical presentation of Forward Head Posture (FHP). FHP was diagnosed through a combination of visual inspection and quantitative assessment, including the Craniovertebral Angle (CVA) measured using digital photographs analyzed with ImageJ software. Participants were recruited from a local physical therapy clinic and were screened to ensure they had no history of significant cervical spine pathology, such as herniated discs, degenerative joint disease, or previous cervical spine surgery or trauma. Additionally, individuals with systemic diseases, neurological disorders, or those currently undergoing treatment for musculoskeletal pain were excluded from the study.

Intervention

The exercise intervention was specifically designed to address the muscular imbalances associated with FHP by focusing on both strengthening and stretching exercises and based on the program of Diab & Moustafa (2021). The program spanned eight weeks, with participants attending three supervised sessions per week. Each session lasted approximately 30 minutes and was divided into three distinct phases: warm-up, core exercises, and cool-down.

Warm-up Phase: Each session began with a 5-minute warm-up that included light aerobic activities; walking or cycling at a low intensity, to increase blood flow to the muscles and prepare the body for exercise. Gentle neck stretches, including side bends and rotations, were also performed to enhance cervical mobility and reduce muscle stiffness.

Core Exercise Phase: The core component of the exercise program was focused on two key areas: strengthening the deep cervical flexors and stretching the cervical extensors.

Strengthening Exercises: Participants performed specific exercises aimed at activating and strengthening the deep cervical flexors, such as the chin tuck exercise and isometric neck flexion. These exercises were initially performed with the head supported (e.g., lying supine), progressing to more challenging positions (e.g., sitting or standing) as participants demonstrated improved control and strength.

Stretching Exercises: To address the shortening of cervical extensors commonly observed in FHP, stretching exercises such as upper trapezius and levator scapulae stretches were incorporated. These exercises were performed slowly and held for 20-30 seconds, with an emphasis on maintaining proper posture throughout the stretch.

Cool-down Phase: The session concluded with a 5-minute cool-down period, which included slow, controlled breathing exercises and gentle neck stretches to help relax the muscles and prevent post-exercise soreness. Participants were also encouraged to perform additional stretching exercises at home as part of a daily routine to reinforce the benefits of the program.

Throughout the eight-week intervention, the intensity and duration of the exercises were progressively increased based on each participant's improvement in strength and flexibility. The sessions were conducted under the supervision of a licensed physical therapist to ensure proper technique and to make real-time adjustments as needed.

Outcome Measures

The effectiveness of the exercise program was evaluated using several primary outcome measures, focusing on pain intensity, cervical Range of Motion (ROM), and functional disability.

Pain Intensity: Pain was assessed using the Visual Analog Scale (VAS), a widely recognized tool that allows participants to rate their pain on a scale of 0 to 10, with 0 representing "no pain" and 10 representing "worst possible pain." Participants were asked to rate their pain at rest, during neck movement, and after completing daily activities to provide a comprehensive understanding of their pain levels throughout the day (Iizuka, 2015).

Cervical Range of Motion (ROM): Cervical ROM was measured using a standard goniometer, an instrument used to assess the angle of joint movement. The measurements focused on three primary movements: cervical flexion, extension, and rotation (both left and right). ROM was assessed by having participants sit in a neutral position and perform the specified movements to their maximum range, with the angle recorded by the therapist. These measurements were taken at three time points: baseline (before the intervention), at the midpoint (four weeks into the program), and at the conclusion of the eight-week intervention.

Functional Disability: Functional disability was evaluated using the Neck Disability Index (NDI), a validated self-reported questionnaire designed to measure the impact of neck pain on daily activities. The NDI consists of 10 items, each scored on a scale of 0 to 5, with higher scores indicating greater disability. The items assess various aspects of daily life, including pain intensity, personal care, lifting, reading, work, driving, sleeping, and recreation (Vernon & Mior, 1991). Participants completed the NDI at the same three time points as the ROM measurements.

Statistical Analysis

All statistical analyses were conducted using IBM SPSS 26. Data were reported as mean values and standard deviations using descriptive analysis for changes in pain intensity, cervical ROM, and NDI scores in both participants.

RESULTS

Descriptive Analysis

Pain and Disability

Both subjects exhibited a significant reduction in pain and functional disability following the intervention. Subject A experienced a 47.37% decrease in VAS scores, while Subject B saw a 52.63% reduction. In terms of

NDI, Subject A's score decreased by 42.86%, and Subject B's score decreased by 38.89%. Detailed statistical summaries are provided in Table 1.

Table 1. Changes in pain and disability pre- and post-therapeutic exercise.

	Subject A		Subject B	
	Pre-test	Post-test	Pre-test	Post-test
VAS (mm)	57	30	38	18
NDI (score)	14	8	18	11

Cervical Range of Motion

Improvements in cervical ROM were observed in both subjects. Subject A showed increases in flexion (13.84%), extension (15.25%), right rotation (9.54%), and left rotation (26.32%). Similarly, Subject B demonstrated gains in flexion (13.89%), right rotation (39.61%), and left rotation (3.49%).

Table 2. Changes in cervical ROM pre- and post-therapeutic exercise

	Subject A		Subject B	
	Pre-test	Post-test	Pre-test	Post-test
Flexion	35.4	40.3	29.5	33.6
Extension	70.2	80.9	65.1	66.2
Right rotation	30.4	33.3	55.3	77.2
Left rotation	60.4	76.3	63.1	65.3

DISCUSSION

This study highlights the potential benefits of a targeted therapeutic exercise program in addressing Forward Head Posture (FHP) among healthy adults. The exercise intervention, which focused on strengthening deep cervical flexors and correcting muscular imbalances, led to a notable reduction in pain and functional disability and improved cervical Range of Motion (ROM) for the participants.

The reduction in pain and functional disability observed is consistent with previous research that supports the effectiveness of exercise interventions for FHP. Studies have shown that strengthening exercises targeting the deep cervical flexors and stretching the cervical extensors can alleviate discomfort and improve postural alignment. For example, a study by Yeldan et al. (2015) demonstrated that a specific exercise regimen effectively reduced pain and improved cervical function in patients with FHP. Similarly, a study by Tontodonati et al. (2020) found that exercises designed to correct FHP led to significant improvements in postural alignment and pain reduction.

The observed improvements in cervical ROM align with findings from other studies that emphasize the role of targeted exercise in enhancing cervical spine mobility. A meta-analysis by Lee et al. (2017) highlighted that interventions involving stretching and strengthening exercises are effective in increasing cervical ROM and reducing stiffness. The current study's results support these findings, indicating that the exercise program not only alleviates pain but also enhances the flexibility and mobility of the cervical spine.

In this case study, both subject A and B showed a decrease in VAS and NDI scores post-exercise compared to pre-exercise. This suggests that therapeutic exercises, including deep cervical flexor strengthening, can reduce neck pain and disability in patients with Forward Head Posture (FHP). According to Fernández-de-las-Peñas et al. (2005), FHP increases excessive pressure on the posterior aspects of the vertebral body and facet joints, leading to reduced movement in the head and neck region. Morningstar et al. (2003) reported that individuals with FHP exhibit excessive extension in the upper cervical spine while experiencing hypomobility in the lower cervical spine, which reduces range of motion (ROM) in flexion, side bending, rotation, and extension.

In this case study, patient A showed improvements in cervical range of motion (CROM) for flexion, extension, right rotation, and left rotation by 13.84%, 15.25%, 9.54%, and 26.32°, respectively, following therapeutic exercises. Patient B demonstrated improvements in CROM for flexion, extension, right rotation, and left rotation by 13.89%, 1.69%, 39.61%, and 3.49°, respectively. The study confirmed that patient A's cervical flexion, extension, and right and left rotation ROMs improved to within normal ranges, while patient B's cervical extension, right rotation, and left rotation ROMs also improved to normal ranges.

Despite these promising results, the study's small sample size is a limitation that affects the generalizability of the findings. Previous research suggests that larger sample sizes are needed to confirm the effectiveness of such interventions and to explore their long-term impact. For instance, a study by Cramer et al. (2016) emphasized the need for studies with larger sample sizes to validate the efficacy of exercise interventions for postural corrections and pain management.

Future research should include a larger and more diverse sample to enhance the generalizability of the results. Additionally, long-term follow-up studies are necessary to assess the durability of the intervention's effects and to determine if the benefits observed are maintained over time. Future studies could also explore the impact of varying exercise intensities and durations on FHP outcomes.

CONCLUSION

This study demonstrates that a targeted therapeutic exercise program can effectively improve Forward Head Posture (FHP), reduce pain, and enhance cervical muscle function in healthy adults. The positive outcomes observed—namely the reduction in pain and functional disability and the improvement in cervical Range of Motion (ROM)—suggest that such an exercise program is a viable intervention for addressing FHP and associated symptoms. To build on these findings, future research should involve larger sample sizes to confirm the generalizability of the results. Additionally, more detailed analyses of posture and muscle activation during and after the intervention would provide deeper insights into the mechanisms underlying the observed improvements. Exploring these aspects can help refine exercise protocols and further validate the efficacy of therapeutic exercises for FHP and related conditions.

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