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Effectiveness of Proprioception Training for Patients with Forward Head Posture (FHP) - A Literature Review

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ABSTRACT

Background: Forward head posture (FHP) is a condition marked by the anterior placement of the head, often leading to musculoskeletal issues. Proprioception training, which improves body awareness and movement, has been proposed as a potential intervention for FHP.

Methods: A detailed search was conducted using databases such as PubMed, Google Scholar, and Sci-Hub, focusing on studies published since 2013. The selection process involved reviewing titles, abstracts, and full texts. A total of six relevant studies were analysed, including randomized controlled trials, experimental studies, comparative studies, systematic reviews, and case-control studies.

Result: A total of 6 articles were selected. The review of six studies underscores the potential of body awareness exercises in alleviating discomfort and enhancing balance for individuals with Forward Head Posture (FHP). Customizing these training methods to individual needs is crucial for maximizing their effectiveness.

Conclusion: In conclusion, the effectiveness of proprioception training in addressing Forward Head Posture (FHP) becomes evident through these studies. The exercises, such as head relocation and eye-head coordination, offer a promising approach to alleviating discomfort, improving neck mobility, and enhancing overall body awareness. Embracing proprioception training emerges as a valuable strategy for managing FHP and enhancing overall posture and well-being.

Keywords: Forward Head Posture, Proprioception Training, Poor Posture, and Postural Correction

INTRODUCTION

Forward head posture (FHP), a head-on-trunk misalignment, is characterized by the excessive forward placement of the head inrelation to a vertical reference line. And it often presents with increased lower cervical spinal lordosis, and rounded shoulders, accompanied by thoracic kyphosis[1]. Additionally, FHP is associated with upper cervical hyperextension and lower cervical flexion[2]. The craniovertebral angle serves as a reliable indicator of FHP, with typical range of 48 and 50 degrees[3] in healthy individuals. The ability to make sense of body movement and position is referred to as proprioception[4]. FHP is commonly observed in individuals aged 20-60. The rete of FHP among the student participants was 73%. Radiographs of neck pain patients revealed a 37% FHP frequency of FHP via head translation[5,6,7].

FHP (Fig 1) results from the head extending forward from the typical cervical spine alignment due to factors such as head shifts, reduced upper cervical extension, and lower cervical flexion[8]. This strain affects neck muscles and connective tissues, weakens mid-thoracic scapular retractors and deep cervical muscles, alters scapular position, and tightens anterior neck and shoulder muscles. FHP shifts the center of gravity forward, straining posterior neck muscles and increasing pressure on posterior vertebrae and cervical joints[9]. It also induces a downward position of the glenohumeral joint.

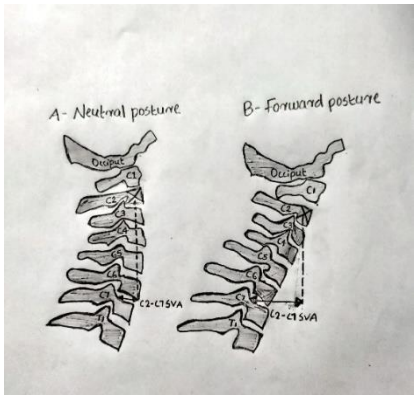

Figure 1

Rotation, protraction, elevation of the shoulder girdle, and backward bending of the occiput all contribute to the restriction of motion in the cervical vertebral column and upper thoracic region.[1].

Multiple risk factors contribute to FHP and its associated problems. These factors include cervical region dysfunction, excessive smartphone use exceeding six hours daily, which strains the neck, sedentary work with prolonged sitting, a history of significant neck or back injuries, repetitive computer use, frequent shoulder and back pain, poor posture combined with muscle imbalances, inadequate ergonomic practices, and the presence of temporomandibular disorders and myofascial pain syndrome[3,5,10,11].

Pain typically begins gradually and worsens with prolonged single positions[12]. Symptoms include neck pain due to muscle shortening, leading to discomfort in the neck, scapula, and head areas, along with a limited range of motion[7]. Muscle imbalance and overuse contribute to fatigue and discomfort[1]. This imbalance, resulting from tight and weak muscles, impairs coordinated control of the neck and occasionally leads to rounded shoulders. Patients often experience neck and shoulder stiffness[8].

Clinical examination involves inspection and palpation to identify hyperextension in the upper cervical spine and pain between T1 and the occiput[7,8]. Additionally, measurements such as the craniovertebral angle(Fig 2), neck disability index, cranial rotation angle, and specialized tests like the Craniocervical flexion test contribute to evaluating FHP. Imaging techniques such as X-rays, MRI, CT scans, and ultrasound are used to assess cervical angles and muscle thickness related to FHP[3,7,12].

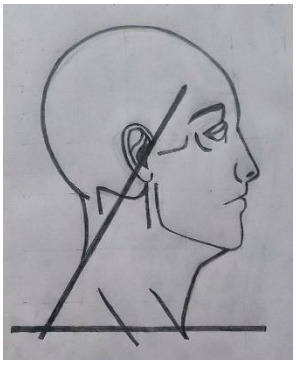

Figure 2

Physiotherapy management involves techniques such as mobilizing the upper cervical and thoracic spine to enhance stability and mobility, utilizing cervical retraction exercises for muscle strengthening, incorporating stretching to alleviate muscle tightness, performing chin tuck exercises, engaging in cervical range of motion exercises, and implementing EMG biofeedback. This technique has been reported to effectively reduce pain, enhance muscular strength, and aid in posture retraining[9].

This study aims to investigate the effectiveness of proprioception training for individuals with FHP and its potential impact on discomfort alleviation, balance enhancement, and overall body awareness improvement. This study is essential due to rising prevalence of FHP caused by sedentary lifestyles and increased electronic device usage. Healthcare practitioners require evidence-based interventions to enhance the well-being of individuals with FHP, and offering valuable insights for healthcare professions and addressing knowledge gaps in FHP management.

METHODOLOGY:

This literature review explores the efficacy of proprioception training for individuals with FHP. English articles from PubMed, Google Scholar, and Sci-Hub were utilized as information sources. The study selection process involved searching key databases using terms like "Forward Head Posture," "Proprioception Training," "Poor Posture," and "Postural Correction." Research evaluation was conducted through title, abstract, and full-text reviews to identify relevant studies for the project.

DISCUSSION

Balance relies on multiple factors, including visual input, proprioception, inner ear and vestibular sensing, cerebellar function, age, heartbeat, respiration and musculoskeletal health, Proprioception, particularly in the neck muscles, plays a crucial role in maintaining proper body alignment due to their high muscle spindle density, which provides essential sensory information to the nervous system.[20,21]

The proprioceptors like joints, muscle proprioceptors, and the golgi tendon organ, it becomes evident that proprioceptive approaches offer the most effective utilization for active participation. The impact of the proprioceptive training on individuals with chronic neck pain was studied by Mehmat Durry et al. Combining proprioceptive training with craniosacral therapy can reduce pain and showed a positive impact of proprioceptive training on both dynamic and static balance.[13]

A previous study investigated the relationship between the cranio-vertebral angle and longus colli area in individuals with FHP found that as the cranio-vertebral angle decreased, the thickness of the longus colli muscle decreased. This finding implies that FHP leads to change in head position when changing the position.[19]

Sung-Young Ha et al. conducted an experimental study emphasizing the significance of maintaining proper head and neck alignment to prevent issues with proprioception and posture. Their findings revealed that induced FHP while watching a smartphone for 40 minutes significantly affected proprioception.[14]

In a comparative study conducted by Isha Shah et al. in 2022, both Cervical Retraction and Muscle Energy Technique interventions were found to effectively improve neck position awareness in individuals with Forward Head Posture, with Muscle Energy Technique showing slightly superior results in all directions, although Cervical Retraction exhibited overall superior efficacy in enhancing Cervical Joint position sense.[15]

In a 2021 interventional study led by Jung-Hyung Choi et al., involving 24 adults with forward head posture (FHP), those who utilized vibrating foam rollers (VFR) demonstrated a slightly greater

improvement in neck pain (Neck Pain Improvement: Difference = 1.52) and a more significant reduction in upper trapezius muscle stiffness (Upper Trapezius Muscle Stiffness Improvement: Mean Difference = -17.62 N/m) compared to those who used non-vibrating foam rollers (NVFR). However, the study revealed that neither group showed significant changes in sternocleidomastoid muscle stiffness or cervical proprioception[22].

In a 2013 systematic review conducted by Cheryl M Petersen, the research aimed to investigate cervical spine repositioning sense and its relevance to cervical spine pain, along with examining the existing literature on rehabilitation strategies for spine repositioning sense. The review revealed that meta-analyses showed significant heterogeneity in outcomes, supporting the use of treatment interventions involving extension, flexion, right, or left rotation to improve position sense and reduce pain in the cervical spine. Furthermore, the review identified positive effects on cervical position sense, supported by two randomized controlled trials (RCTs), with a moderate to large effect size seen in eye-head-neck coordination exercises and a moderate effect size observed for pain reduction through manipulation techniques.[16]

In a 2019 case-control study led by Zeinab Raoofi et al., the research aimed to assess and compare neck proprioception in three groups of female participants: those with Forward Head Posture (FHP) without neck pain (Group 1), those with FHP with a history of neck pain (Group 2), and a control group of healthy females (Group 3), each consisting of 31 individuals. The study found that the parameter most significantly affected was the Absolute Error of repositioning of the Target Angle, with Group 1 having a 3.81 degrees error, Group 2 with a 2.31 degrees error, and Group 3 with a 1.24 degrees error, all in the flexion direction. The results revealed that regardless of the presence of neck pain, Forward Head Posture (FHP) led to increased joint repositioning errors, potentially compromising mechanical stability and disrupting normal kinematic patterns.[18]

Proprioception exercises for FHP

The gaze direction recognition exercise (GDRE) plays a key role, in offering proprioceptive training for individuals managing chronic neck pain. GDRE involves positioning the patient behind the therapist and guiding them to track numbered targets by coordinating head and eye movements with the therapist's line of sight. This encourages the neck muscles to engage their full range of motion and reinforces the connection between vision and neck proprioception. Especially for those dealing with forward head posture, weakened and lengthened neck extensor muscles are common. GDRE aims to strengthen these muscles, enhance control over neck movements, and restore proper alignment of the head with the body. By targeting the cervical spine proprioceptors, GDRE improves their signaling, ultimately enhancing body awareness and posture. Throughout this exercise, the eyes follow targets, while the body simultaneously adapts to maintain a centered head. By combining vision, neck motion, and postural adjustments, GDRE emerges as a versatile and effective strategy for addressing the proprioceptive deficits linked to forward head posture[13].

Combining proprioceptive training with either cervical retraction exercises or muscle energy techniques has proven effective in enhancing cervical joint position sense among individuals with forward head posture. Proprioceptive training targets impaired communication from weakened deep cervical flexors' muscle spindles. Cervical retraction exercises aim to strengthen these flexors through repeated chin tuck contractions while stretching tight suboccipital muscles. This is believed to stimulate muscle spindle sensitivity and enhance proprioceptive cues for better head control. The muscle energy technique assists

by reducing hypertonicity in upper suboccipital muscles through inhibitory reflexes, normalizing tone, and improving positioning sense. Both approaches were beneficial, with retraction exercises possibly offering added gains by directly training the critical deep flexors for proprioceptive input. This underscores the potential of incorporating either exercise regimen with proprioceptive training to enhance cervical neuromuscular control in cases of forward head posture[15].

Various exercises, notably those focusing on coordination training connecting neck proprioception with visual and vestibular systems, can effectively improve neck repositioning sense and provide moderate pain relief. Engaging in consistent eye-head-neck coordination exercises over 4-8 weeks leads to notable enhancements in neck proprioception, likely by better integrating proprioceptive signals with visual and inner ear input, resulting in improved head-neck orientation control. Additionally, spinal manipulation demonstrates moderate benefits for proprioception and pain relief, potentially by stimulating receptors in neck joints and muscles. Exercises targeting deep neck flexor muscles can reduce pain but have limited impact on repositioning sense, likely by improving cervical segment support and alignment. For individuals with atypical head-forward posture, incorporating exercises such as chin tucks and scapular stabilization can be beneficial for posture improvement.[17].

Forward head posture affects proprioception even without pain. Targeted exercises are recommended. Challenges with closed eyes and resistive exercises enhance neuromuscular control. Deep neck muscle exercises aid alignment, while postural correction retrains posture with cues. Integrated programs effectively address the forward head posture's complexity[18].

Proprioception training involves specific exercises that heighten an individual's awareness of body positioning and movement. It's especially useful for tackling forward head posture, where the head is positioned too far ahead of the body. These exercises enhance muscle control, balance, and the sense of proper neck alignment. Regular proprioception training strengthens the muscles supporting the correct neck posture, addresses muscle imbalances from poor posture, and potentially eases related neck discomfort. It's like refining the body's internal guidance system to encourage better posture and possibly reduce neck pain[15,17,18].

This program involved activities such as head relocation, eye tracking, gaze stability, and coordinating eye-head movements.

Head relocation exercise: This exercise aims to improve Forward Head Posture by increasing awareness of head positioning and promoting proper alignment through guided movements, strengthening neck muscles, and nurturing a stronger mind-body connection, utilizing a laser-attached helmet and an eye-level wall target placed 90 cm away from you. Start by sitting comfortably and ensuring the helmet with the laser is securely on the subject's head. Place a target at eye level on the wall, approximately 90 cm away. Find a position where the head feels most comfortable. Move the head in different ways—forward, backward, turning, and sideways—while keeping the eyes open. Use the laser's light to guide the head back to its original position after each movement. Try the head movements again while wearing special glasses that limit pupil movement. This helps enhance the awareness of movement without relying solely on sight. Close the subject's eyes and do the head movements once more. Depend on the internal sense of movement to bring the head back to its natural position. Regularly practice these exercises for a set number of times or a specific duration[15].

Head Relocation Exercise:

Begin by sitting upright with good posture and keeping the subject's eyes open while looking straight ahead. This position represents the neutral head alignment. Gradually turn the head to the left, maintaining a forward gaze with the eyes. Hold this posture for approximately 5 seconds. Revert the head back to the neutral position, relying on the body's sense of position rather than visual input. Perform this sequence of movements 10 times on each side[17].

Oculomotor exercise: Eye exercises are useful for people with Forward Head Posture. These exercises start with moving the eyes and then adding head movements while focusing on a target. This improves gaze stability and body awareness, essential for fixing posture. By linking eye and head movements, these exercises help retrain muscles and cues for better head alignment, ultimately enhancing posture by coordinating vision and muscles. The oculomotor exercises advanced in stages, starting with moving the eyes while keeping the head stationary (Fig 3). This was followed by introducing head movements while maintaining visual fixation on a target (Fig 5) (Gaze stability)[17].

Eye-head coordination exercises: These exercises aim to fix Forward Head Posture by addressing muscle imbalances. Patients practice coordinating eye and head movements, which enhances their sense of body position and strengthens the muscles responsible for proper head and neck alignment. These exercises retrain the brain and muscles to cooperate better, encouraging a more natural head position. Doing these activities while standing engages posture muscles and connects vision with posture[17]. It began by rotating both the eyes and head to the same side (Fig 4), in both left and right directions. Following this, individuals practiced tracking a target using their eyes first, and then the head, all the while ensuring the target remained in focus (Fig 6). To progress even more, patients started by moving their eyes before moving their heads to shift their focus between two targets placed either horizontally or vertically. Additionally, they practiced rotating their eyes and head in opposite directions, to the left and right. These exercises became more challenging by increasing the speed and range of target movement. All these activities were done with patients in a standing position[15,17].

Fig 3 Eye movements with head stationary.

Fig 4 Movement of eyes and head to the same side.

Fig 5 Movement of the head with visual fixation.

Fig 6 Eyes leading first to target followed by head

CONCLUSION

In conclusion, the literature review underscores the potential effectiveness of proprioception training in addressing forward head posture. The study has revealed valuable insights by analysing how diverse proprioceptive exercises impact factors such as neck discomfort, flexibility, balance, and posture. This

highlights the viability of customized proprioception training as a non-invasive approach to managing forward head posture.

CONFLICT OF INTEREST: No conflict of interest.

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