Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 1117-1121 | ISSN:2251-6727

Forward Head Posture and its Negative Impact on Respiratory Function: A Review Study

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(Received: 04 February 2024 Revised: 11 March 2024 Accepted: 08 April 2024)

KEYWORDS
Forward head posture, Respiratory Biomechanics, Thoracic mobility

Abstract

Background: Forward head posture is one of the most reported musculoskeletal affections in general population. It has a tremendous impact on health and quality of life of the individual and on the society. These patients are primarily managed with a musculoskeletal perspective and that is the first treatment of choice and there is almost little or no emphasis to the changes observed in the respiratory system. There is a scarcity of literature evaluating the need for respiratory assessment in these patients.

Main Body: All relevant published literature related to respiratory dysfunction in patients with forward head posture were critically reviewed in this study. Patients having forward head posture were found to have alterations in respiratory biomechanics and they were associated with changes in posture. Each muscle involved in respiration is deeply impacted by Forward head posture thus leading to breathing difficulties.

Conclusion: There is limited literature relating to respiratory dysfunction and its management in forward head posture patients. Therefore, both respiratory and musculoskeletal assessments should be incorporated so that their treatment outcomes will enhance.

Background:

According to National Academy of Sports Medicine (NASM), FHP is defined as holding the head out, in front of its natural position over the cervical spine. A person having Forward Head Posture also typically tilts their head back to look forward. Forward head posture is one of the most reported musculoskeletal affections in general population. It has a tremendous impact on health and quality of life of the individual and on the society. Another domain which has not been clearly examined and there is a scarcity of evidence that Forward head posture has a huge effect on respiratory biomechanics which leads to

breathing difficulties as well. In a study it has been proved that Forward head posture greatly impacts the cervical musculature which further leads to labored breathing therefore respiratory function is compromised.[(1)] In another study, it has been shown that continuous protrusion of neck leads to adaptation in the thoracic vertebrae, which results in ribcage modification . [(2)] These changes affect the inter-costal muscles which includes diaphragm leading to breathing alterations. [(2-3)] In the case of breathing with FHP, the ribcage is expected to be raised forward and outward, while the upper thorax is mechanically placed more forward, resulting in a higher activity of the upper inter-costal muscles to effectively assist in ventilation which further leads to fatigue. [(2,4)] Various studies have reported the association of respiratory dysfunction in patients with forward head posture. [(5-8)] Patients with Forward head posture have disturbed respiratory biomechanics[(6)] and also present with decreased Forced vital capacity and more usage of sternocliedomastoid and scalene muscles .[(6)] According to Masahiro Itoh et al, all these respiratory parameters such as FVC,ERV, IRV and FEV1 are low in subjects with Forward head posture. They concluded that FHP leads to upper thoracic expansion and lower thoracic contraction which led to decreased respiratory function [(2)] Zacharias Dimitriadis, et al in a study concluded that patients with neck pain

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have reduced VC, FVC, ERV, and MVV. Respiratory function is also positively correlated with kinesiophobia, neck muscle strength and pain intensity. It is found that pulmonary function is affected in neck pain patients. Also, muscles of cervical spine do not function properly. [7] A study done by RT Okuro et al concluded that degree of FHP is directly correlated with effect on chest expansion and respiratory muscle activities which if increases, reduces the alveolar ventilation. [9] All these studies explain the importance of Forward head posture and its association with respiratory biomechanics. Any kind of alterations of head and neck positions can have an immediate negative effect on respiratory function. Therefore, there is a need to highlight the respiratory issues which are purely caused by Forward head posture. This will lead to better assessment and outcome in the future. The current study critically reviewed all the relevant published literature regarding the respiratory consequences of Forward head posture.

Methods:

A literature search was conducted on PubMed, ResearchGate, Google Scholar, and MEDLINE databases. The studies published in the last 30 years from the year 1995 to 2021 were included in this review. The inclusion criteria were studies published in the English language involving human subjects, studies analyzing respiratory dysfunction, biomechanics, and forward head posture. Exclusion criteria were studies that were published before 1995, the ones that did not assess the outcomes of interest including studies assessing acute or traumatic neck pain or pain associated because of any neurological cause or studies which were not related to forward head posture. The initial search yielded one hundred and thirteen articles. Studies whose title is related to the topic were shortlisted, and after excluding research for content irrelevance, a total of twenty-five studies were finalized for this review. Twenty-five studies included one randomized control trial, four cross-sectional studies, one pilot study, three comparative studies, three systematic review studies, one prospective cohort study, one randomized control trial study and twelve experimental research studies.

Main text:

1) Assessing the Respiratory function in patients with neck pain

Respiratory function can be best described by assessment of rib cage mobility, respiratory muscle strength, neck posture, and pulmonary function test results. [10]

2) Postural changes in Forward Head Posture

Studies have shown that thoracic kyphosis is positively correlated with forward head posture (FHP), and this is directly related with age. [11] Although younger generations are also prone to the coupling of FHP and kyphosis because of longer screen time in computer or gadgets. [12] Therefore, it can be assumed that the changes are not completely based on degenerative changes, rather than a biomechanical compensation towards the anterior shifting of the centre of gravity by the head. [13,14] Another study mentioned that FHP causes change in various muscle lengths for prolonged periods which further reduces proprioception along with worsening of FHP. Therefore, when muscle recruitment and proprioceptive sense is disturbed, a balance disorder occurs which further decreases overall mobility. [14-16]

3) Effect of Forward Head Posture on thoracic shape and respiratory function

FHP evaluation is clinically very important for diagnostic and rehabilitation purposes because FHP increases compressive load on tissues in the cervical spine (mainly the facet joints and ligaments). [17,18] Studies have reported that symptoms such as headache, temporomandibular pain, and musculoskeletal disorders are correlated to FHP. [19,20] In addition, FHP also causes weakening of respiratory muscles. [21,22] In a prior study, Silveira et al. showed that respiratory function is affected by FHP. [23]

Finally, it was reported that FHP resulted in weakened respiratory function [24] and this was improved by manual therapy [24] and therapeutic exercise. [24-25]

4) Forward Head Posture and the muscles involved in respiration

FHP individually causes a negative impact on the muscles involved in breathing such as Inspiratory muscles, Accessory Inspiratory muscles and Accessory

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Expiratory muscles. Diaphragm is the primary muscle involved in respiration and it plays a crucial role in breathing. However, FHP is a cervical vertebrae disorder, but it also disrupts the natural sagittal curves of the spine and these changes in the thoracic vertebrae affect all the muscular attachments of the diaphragm thus leading to respiratory consequences. [(2)] Sternocleidomastoid muscle is the major accessory muscle of inspiration and it is directly in line of action in the atlanto occipital joint. Therefore, FHP alters its biomechanics by stretching the muscles of its proximal and distal attachments. [(3)] In a study, a cadaveric computed tomography-based anatomic analysis was done and they measured FHP severity by checking horizontal displacement from Occiput to T1. That study proved that sternocleidomastoid muscle is shortened by maximum of 5.4% with FHP. [(2)] Internal intercostal muscles play a major role in the expiration process and various studies have shown that these are affected in FHP. In a recent study they proved that there is a reduction of ribcage motion during expansion and normally there is an expansion of upper thorax in FHP which leads to increased energy requirement to further bring down the ribcage and the length tension relationship between them is affected. [(2,3,26)]

Conclusion:

Patients having forward head posture present with altered chest mechanics, abnormalities in pulmonary function tests, and decreased strength of respiratory muscles. Muscle biomechanics is strongly altered in subjects having FHP and each function of respiration is greatly impacted. Looking at the available literature, it is evident that there are very few studies that have evaluated the effect of respiratory intervention in these patients. This seems to have been a largely ignored aspect that forward head posture impairs the respiratory biomechanics. Therefore, comprehensive protocol inclusive of assessment of respiratory function and incorporation of respiratory therapies in the form of breathing re-education and breathing retraining should be undertaken in these patients. This could certainly enhance the treatment outcomes and largely benefit the patients to achieve faster recovery.

Abbreviations:

FHP (Forward Head Posture), NHP (Normal Head Posture), FVC (Forced Vital Capacity), ERV (Expiratory Reserve Volume), IRV (Inspiratory Reserve Volume), FEV1 (Forced Expiratory Volume in 1 Minute), VC (Vital Capacity), MVV (Mean Ventilatory Volume), ROM (Range of Motion)

Acknowledgements:
Not applicable

Funding:
Not applicable

Ethical approval:
Not applicable

Consent to participate:
Not applicable

Competing interests:
None

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