



Correlation of Forward Head Posture with Functioning of the Lungs: A Review Study

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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 function in terms of reduced lung volumes, reduced chest mobility, and decreased respiratory muscle strength. Numerous factors including decreased cervical range of motion, decreased strength of deep neck muscles, forward head posture, and pain are the main causes which leads to dysfunction.

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 in order 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. In a study which examined the prevalence of Forward head posture and its efficacy on several different conditions, 66% of the general population had abnormal posture which was associated with the development and persistence of many disorders, including cervicogenic headache and

migraine, myo-fascial pain syndrome, abnormal shoulder blade movement, abnormal respiratory mechanics and temporo-mandibular joint disorder.⁽¹⁾ In a recent systematic review conducted in Hong Kong, the prevalence of musculoskeletal problems with mobile phone usage were high ranging from 17.3% to 67.8% for neck complaints.⁽²⁾ On using the mobile phone over long periods of time, users usually adopt prolonged forward head posture.⁽³⁻⁶⁾ A recent study done in Thailand shows that Text Neck syndrome has become a global epidemic affecting a large number of populations of almost all ages who use mobile phones. Text neck syndrome is a growing health problem and may affect large number of populations throughout the world.⁽³⁾ Various studies have reported the association



of respiratory dysfunction in patients with forward head posture. ⁽⁷⁻¹¹⁾ Patients with Forward head posture have disturbed respiratory biomechanics⁽⁷⁾ and also present with decreased Forced vital capacity and more usage of sternocleidomastoid and scalene muscles. ⁽⁸⁾ 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 ⁽⁹⁾ Zacharias Dimitriadis, et al in a study concluded that patients with neck pain 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. ⁽¹⁰⁾ According to another study done by Mohamed Fawzi Awadallah, et al, they concluded that pulmonary function is affected in patients with severe neck pain and this also affects cervical ROM. ⁽¹¹⁾ All these studies explain the importance of Forward head posture and its association with respiratory biomechanics. The current study critically reviewed all the relevant published literature regarding the association of respiratory dysfunction and Forward head posture.

Methods:

A literature search was conducted using databases such as PubMed, ResearchGate, Google Scholar, and MEDLINE. The studies published in the last 20 years from the year 2001 to 2021 were included in this review. Studies published in English language were taken as inclusion criteria. These involved human subjects, studies assessing respiratory function, neck pain and forward head posture. Studies which were published before 2001 were taken as exclusion criteria and the ones that did not assess the outcomes of interest were excluded 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 ten articles. Studies whose title is related to the topic, i.e., relationship between respiratory function and forward head posture, were shortlisted, and after excluding research for content irrelevance, a total of twenty-six studies were finalized for this review. Twenty-six studies included one randomized control

trial, two cross-sectional studies, one pilot study, two comparative studies, five systematic review studies, three survey studies and twelve experimental research studies.

Main text:

1) Assessing the Respiratory function in patients with neck pain

Respiratory function can be best described by taking these parameters for assessment such as assessing rib cage mobility, respiratory muscle strength, neck posture, and pulmonary function test results. ⁽¹²⁾

2) Forward Head Posture

Forward head posture (FHP) precedes neck pain which mostly happens due to reduced strength of deep flexors and extensors thus further leading to muscle imbalance and segmental instability. ⁽¹³⁾ Changes in the thoracic spine and reduction of thoracic mobility are also noted. These morphological changes cause impairment in respiratory function. ⁽⁹⁾

Therefore, Wirth B, Dimitriadis Z, and Kapreli E assessed the forward head posture using a digital picture which was taken in the lateral view for each subject. A 3D drawing program was used to calculate the cranio-vertebral angle (Auto-CAD 2000; Autodesk Inc., San Raphael, CA, USA). ^(10,12,15,16) Kapreli et al. conducted a pilot study comparing chronic neck pain patients and healthy controls further suggesting that forward head posture was associated with the lung function parameters leading to lung dysfunction in neck pain patients. ⁽¹⁶⁾ However, Dimitriadis, Wirth et al., and Ibañeta López-de-Uralde-Villanueva conducted similar studies but they could not find any significant differences in head posture when compared between patients with chronic neck pain and healthy controls. ⁽¹⁵⁻¹⁷⁾ Özge Solakoğlu et al. also contributed while investigating the relationship between FHP and respiratory dysfunction in patients having chronic neck pain. For the assessment of FHP, two measurements were obtained with the help of radiographs using the Picture Archiving and Communication System (PACS, General Electric Healthcare, NY, USA) software. In the first group, patients with an anterior head translation distance of >15mm were assigned as the FHP group, and those with a displacement of ≤15mm were assigned as the normal head posture group. In the second method, they measured C7 vertebrae position (C7°)



further stating that $C7^\circ$ is closely related to the static alignment of the cervical spine and was thought to be proportional to FHP. ⁽¹⁸⁾ Jinal A. Mamania, et al conducted a study in which they took the data by convenient sampling. Two researchers examined the participants for CV angle & CH angle. ON Protractor smart phone application and 'AutoCAD®' software was used for the same. There was another examiner who analyzed the anthropometric and descriptive data. They concluded that ON Protractor smart phone application is a reliable tool for measuring CV angle and CH angle. ⁽¹⁸⁾

3) Pulmonary Function

This is a non-invasive tool which is used for assessing the lung function and provides correct information regarding the complete diagnosis of lung diseases. ⁽²⁰⁾ An electronic spirometer is used for PFT study (Spirolab II; SDI Diagnostics Inc., Easton, MA, USA, and Spirobank II USB MIR, Rome, Italy) are mainly used according to the guidelines of The American Thoracic Society of Standardization of Spirometry and European Respiratory Society (ATS/ERS) ^(10,21,22) or with the help of a Master Scope PC spirometer (Jaeger, Hoechberg, Germany). ⁽¹⁵⁾ Commonly used parameters for assessing neck pain patients through PFT were forced vital capacity (FVC), vital capacity (VC), forced expiratory volume in 1s (FEV1), FEV1/FVC, forced expiratory flow (FEF25-75%; FEF25%, FEF50%, FEF75%), and mean ventilator volume (MVV). ^(10,15,21,22) Kapreli et al. provided the evidence of effect of pulmonary function in chronic neck pain patients and he was the first one to do that. The findings of this study revealed that patients with chronic neck pain had reduced values of FEV1, FVC, and FEV1/FVC ratio and MVV thus proving the data significant ⁽²²⁾ Another study in which Awadallah M F et al. examined the relationship between lung function and chronic neck pain. It was found that these patients had reduced pulmonary parameters. Out of the all the participants who were included in the study, 52% significantly presented with reduced FEV1/ FVC values thus indicating a restrictive pattern. ⁽¹¹⁾ Özge Solakoğlu in his study assessed pulmonary function in neck pain patients by a device named as Vmax™ Encore body plethysmography device and body cabin. The patients having neck pain were assessed for forward head posture (FHP) and were further divided into 2 groups

(FHP and NHP). There was a weak negative correlation between FHP and FEV1/FVC%, FEF 25–75%, and FEF75%. ⁽²³⁾ Kim MS et al recently conducted a study in which they took a sample of 33 healthy young adults and measured CV Angle, CR angle, VC, FVC, FEV1, MVV, PEF and also measured the ratio of activities done by sternocleidomastoid and upper trapezius further concluding that Forward Head Posture lowers respiratory functions so correct head posture should be maintained to prevent functional reductions. ⁽²⁴⁾ Nijal M Parmar, et al conducted a study in which they took a sample of 120 subjects. Pre-evaluation of the subjects was done with the help of a Flexi-ruler for kyphotic & lordotic curve before data collection. Measuring tape was used to check Pectoralis minor tightness. PFT was done to take measurements such as FEV1, FVC, MVV, FEV1/FVC & MVV*40/FEV1. They concluded that Pulmonary function parameters have a poor correlation and respiratory mechanics is not impaired due to pectoralis minor tightness but due to FHP of healthy individuals. ⁽²⁵⁾ Jintae Han, et al in their study took a sample size of 26 subjects and they were divided into two groups having normal head posture and forward head posture. Spirometry was done to check FVC and FEV1. During deep breathing, accessory respiratory muscle activity was checked by electromyography. They concluded that there is weakness and disharmony of accessory respiratory muscles in subjects having FHP which further reduces vital capacity. ⁽²⁶⁾ Eleni Kapreli, et al conducted a study in which they took the data of neck pain patients and evaluated that there are multiple factors which cause dysfunction of respiratory system. Factors such as decreased strength of deep neck muscles, the hyperactivity and increased fatigue in superficial neck flexors, the limitation of ROM, reduction of proprioception and problems in neural control. They further concluded that neck pain creates a negative impact on respiratory function. ⁽¹³⁾

Conclusion:

Forward head posture in patients with neck pain also leads to altered chest mechanics, abnormalities in pulmonary function tests, and decreased respiratory muscle strength. Neck pain was also found to be associated with forward head posture, decreased cervical mobility, reduced strength of cervical flexors and extensors, and presence of psychological parameters like kinesiphobia. Reviewing the available



literature clarifies that there are very few studies that have evaluated the effect of respiratory intervention in FHP patients in detail. This seems to have been a largely ignored aspect that forward head posture impairs the respiratory biomechanics. Therefore, comprehensive protocol should be developed along with the assessment of respiratory function and respiratory therapies should be incorporated in the form of breathing re-education and retraining. This could certainly enhance the treatment outcomes thus leading to 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), C7 (7th cervical vertebrae), CV angle (Cranio-vertebral angle), CH angle (Cranio-horizontal angle), PFT (Pulmonary Function Testing), FEV1/FVC (Ratio of Forced Expiratory Volume in 1 Minute & Forced Vital Capacity), FEF (Forced Expiratory Flow), NHP (Normal Head Posture), TEXT NECK SYNDROME (Neck pain due to mobile phone usage)

Ethical approval:

Not applicable

Competing interests:

None

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