Mini Narrative Review
Acta Medica Academica 2022;51(2):123-127
DOI: 10.5644/ama2006-124.380

Text Neck Syndrome: Disentangling a New Epidemic

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Received: 15 June 2022; **Accepted:** 22 August 2022

Abstract
The aim of this report is to provide a brief review of the predisposing factors for Text Neck Syndrome, along with diagnostic and therapeutic approaches in young and adult populations. Text neck pain is a worldwide public health problem, largely reported nowadays. Currently, data have shown that the erroneous use of personal computers and cell phones might be correlated with the development of various clinical symptoms that are defined as "text neck syndrome". Modified radical changes in everyday life may ameliorate the powerful forces on the cervical spine that can lead to cervical degeneration, along with other developmental, medical, psychological, and social complications that are attributed to text neck syndrome. **Conclusion.** New technologies and the potentially harmful addiction to cell phones and computers while reading or texting are inducing an epidemic of text neck syndrome. By focusing on postural correction, both pain alleviation and a better quality of life can be achieved for the patient. The predisposing factors and therapeutic approaches for this syndrome that affects public health remain to be further elucidated.

Key Words: Text Neck ▪ Anatomy ▪ Syndrome ▪ Spinal Pain.

Introduction

Neck pain in general is a global cause of disability. It is a public health problem that has increased remarkably nowadays. The prevalence, independent of age, is high, and equal to low back pain. Epidemiological data indicate that 73% of university students and 64.7% of people who work from home have neck or back pain. 39.2% of them admit to being less productive due to neck or low back pain (1, 2). Indeed, the unavoidable addiction to personal computers and cell phones for texting has contributed to the increase in the prevalence of neck pain.

To understand better the anatomy and physiology of human posture the following definitions are provided:

- Posture is the structural framework of the human body intended to resist gravity while humans are standing, sitting or moving, by maintaining an upright position.
- In order to examine and locate the different distortion patterns better, four Posture Quadrants are used: PQ 1: includes the head and cervical spine ("craniocervical posture"), PQ 2 includes the upper limbs, the shoulders, scapulae, thoracic spine and ribcage, PQ 3: affects the lumbar spine and the pelvis, and PQ 4: extends from the femoral head of each leg to the distal phalanges of each foot.
- Forward Head Posture (FHP) is defined as a postural distortion pattern involving the head and neck, the 1st PQ, characterized by protrusion of the head in a sagittal plane so that it is placed anterior to the trunk. It is found in 2 types: the 1st is characterized by the flexion of the cervical spine (as when looking down at a cell phone), and the 2nd type is when the lower cervical spine remains in flexion while the upper cervical spine is extended to keep the gaze at the horizontal level (as when someone is looking at a computer screen in front of them).

There is growing evidence that, compared to neutral standing, adults, or even children, display more FHP when viewing a cell phone (3). Moreover, FHP leads to mechanical strain forces on the joints and ligaments of the cervical spine, and as a result there is increased gravitational force on the posterior neck musculature. Altogether, these factors play a crucial role and support a biomechanically based hypothesis. Inappropriate neck posture while reading or texting on personal computers and cell phones leads to the manifestation of a complex cluster of clinical symptoms commonly defined as "Text Neck Syndrome" (TNS). TNS can be diagnosed and screened by physiotherapists, or even by self-perception, with estimation of the frequency of neck pain. The core of the early diagnosis and screening of the high risk population to present TNS is based on history, clinical examination and posture imaging. The cervical spine seems to be more vulnerable than the lumbar. Undoubtedly, use of many new technological devices involves an unnatural neck position, and this implies an association with neck pain. However, the etiopathogenesis of neck posture and neck pain remains to be elucidated further.

The aim of this study is to provide a brief review of the predisposing factors of Text Neck Syndrome, along with diagnostic and therapeutic approaches in young and adult populations.

The Etiopathogenesis and Symptomatology of TNS

The main factor which exacerbates this clinical condition is looking down for prolonged periods of time with the cervical spine in flexion, as when using a smartphone or tablet, reading on a laptop, or when protruding the head forward while viewing a computer screen. Mechanical stress in the cervical spine due to erroneous cell phone use induces poor posture and incorrect body alignment, which is associated with dysfunctional movement patterns, weak balance-ability and distorted function of the respiratory, circulatory, digestive, and nervous systems**.** In addition, sleeping in an improper posture, in which the normal curves of the spine are not "respected", e.g. sleeping in prone position, with the lumbar spine in extension and the cervical spine rotated and extended, or sleeping on the side forming a "C" – shape, can also result in FHP.

Furthermore, FHP can be associated with cervical spatial change, and a decreased range of motion (ROM), respiratory dysfunction, decreased vital capacity, dysfunction of the temporomandibular joint, carpal tunnel syndrome, and impaired proprioception. The visual system is of paramount importance to the neurology of the posture system, as it controls 70% of postural activities. Working with decreased visual acuity or eye movement dysfunction, patients will develop postural distortion patterns to compensate for this deficit. In order to correct the posture in this situation, correction of the patient's visual system is first required.

On the other hand, many individuals experience eye discomfort and vision problems when viewing digital screens for extended periods. The level of discomfort appears to increase with the amount of digital screen use. This results in so-called computer vision syndrome. Three major mechanisms that lead to this syndrome are the extraocular mechanism, accommodative mechanism, and ocular surface mechanism. In addition, the visual effects of the computer, such as brightness, resolution, glare and quality, are all known factors that contribute to computer vision syndrome. Prevention is the most important strategy in management. Modification of the ergonomics of the working environment, as well as controlling the lighting and glare on the device screen, taking frequent breaks, and education in proper posture and proper eye care are all crucial (4).

Other symptoms that accompany FHP are neck pain, shoulder tightness, headaches and migraines, jaw pain, and pain down the arm and forearm. As the head protrudes forward into a forward head posture, the tragus of the ear shifts forward in relation to the shoulders' coronal level. This is observable on posture imaging, i.e. by picturing the patient's posture to gain an accurate clinical finding which helps the patient's education, and

provides us with a precise way to measure clinical outcomes. The angle between the tragus of the ear to the C7 vertebrae and the horizontal line of C7 is called the "craniovertebral angle", which is one of the most reliable methods to assess the degree of FHP (5). A smaller craniovertebral angle indicates a greater degree of FHP (5).

The Anatomy and Biomechanics of TNS

FHP has been associated with increased load on the cervical spine (6) and changes in the length and strength of cervical muscles (7). FHP disturbs the delicate and complex mechanisms of balance as the Center of Gravity (COG) of the head gets dislocated in an anterosuperior direction. In addition, the COG of the whole body will be modified and will affect the postural control of all joints and the torso. By positioning the head forward, the distance between the sternum and the mandible increases, and as a result the infra-supra hyoid muscles are stretched and weakened by pulling back and down the mental protuberance (8).

In FHP the mastication muscles pull the mandible so to maintain the mouth closed, while the infrahyoid muscles contract in order to depress the mandible and retract it towards a posterior direction. The muscles of the thoracic wall (the intercostal muscles, pectoralis major and minor, serratus anterior) will present impaired mobility, as well as the muscles of the cervical spine and head (i.e. the levator scapulae, sternocleidomastoid, upper trapezius, the scalene and suboccipital muscles, the rectus capitis posterior major and minor, as well as the obliquus capitis inferior and superior). As for the rhomboids, middle trapezius, and supra- and infrahyoid muscles, they will appear stretched and will become weak in prolonged FHP (9). Generally, the muscular imbalances associated with FHP result from the combination of the elongation and weakening of the anterior neck muscles, and the contraction and stiffness of the posterior neck muscles (10).

Another aspect of TNP syndrome is the alignment of the neck with the centers of the shoulder, diaphragm and pelvic rings on a vertical line. Any deviation from this structural relationship means that the deep fascia, known as the myofascia, is of paramount importance regarding the musculoskeletal system-of the upper pole, which is disturbed. A dysfunctional position of the head can lead to occlusal problems and vice versa, or tooth gearing problems, that can affect the balance of the head on the neck.

The sternocleidomastoid muscles (SCM), acting unilaterally, cause ipsilateral-lateral flexion, contralateral rotation and lift the chin. Acting bilaterally, they help in head stabilization by flexion of the lower cervical spine and extension of the upper cervical spine (11). In chronic FHP, the SCM muscles exert strenuous force to hold the head upwards, and become short, tight and weak. The hyoid bone floats below the tongue, providing attachment points for both the delicate supra and infrahyoid muscles.

Incorrect posture for a long period of time, without respecting the normal kinematics of the spine and the position of the major joints, such as the shoulder joint (glenohumeral) and the hip joint, may create disorder in all four posture quadrants of the body. A swayback posture leads to FHP. A craniocervical and thoracopelvic posture (i.e. the position of the pelvis related to the thoracic and lumbar spine) is therefore a relatively important aspect in the treatment of the temporomandibular joint. A domino effect will occur when bending the head forward, as the COG is transferred forward. For compensation, the upper thorax increases the kyphotic curvature of the thoracic spine, that will result in the raising of the lordosis of the lumbar vertebrae. The shift of the COG will affect the biomechanics of the entire spine, as well as the slope of the pelvis.

The Anatomical Complications of TNS and Other Correlated Consequences

Adults with neck pain show increased FHP when compared to asymptomatic adults, so FHP is significantly corrected by neck pain measures in adults and older people (12). FHP and thoracic shape have been reported to impact respiratory

function. Research has shown that forward head posture causes expansion of the upper thorax and contraction of the lower thorax, and these morphological changes cause decreased respiratory function. FHP is also associated with reduced proprioception (kinesthesia), which subsequently leads to cervical sensorimotor control disturbances. The delicate proprioceptive system of the cervical spine controls posture and balance. The change in muscle strength caused by FHP decreases the joint position sense (5, 13). It was also found that the more severe FHP becomes, the worse the proprioception will become (12, 14).

Concerning university students, it has been found that FHP is not significantly associated with disability, but does affect stress levels. Following research, it has been determined that participants with FHP exhibited abnormal sensorimotor control and autonomic nervous system dysfunction, in comparison with those presenting with simple normal head alignment (6, 15).

Treatment Plans and Exercise Ameliorate TNS Symptomatology

Therapeutic approaches for TNS include a 10-week home-based targeted exercise program that can improve postural alignment related to forward head posture. The aim of these exercises is to reverse the posture. By focusing on postural correction, both pain alleviation and a better quality of life can be achieved for the patient.

Other effective treatments for FHP may include posture exercises, oculomotor tasks, posture tape, respiratory exercises, and ergonomic corrections for the professional, as well as the home environment. Therapeutic exercises may result in major changes to the craniovertebral angle and moderate improvement in neck pain in participants with FHP. Modified cervical exercises that were performed for only a relatively short duration (four weeks) showed an improvement in forward head posture induced by using a smartphone (7, 15).

Finally, TNS may impact the normal development of children. Using tablets and cell phones most of the day with abnormal posture may impact neurological development during childhood and later in adulthood, which leads to pain and other dysfunctions. Incorrect posture patterns can be associated with poor respiration, poor balance, and neck and lumbar pain headaches, because of the body movements forward and down, that may cause hyperventilation, stress, and anxiety. Just by changing posture, ventilation is improved, and the better overall function of the nervous system and body in general is achieved.

Conclusion

Proper posture while using hand-held mobile technological devices at any age must be taught by physiotherapists with personalized exercise and related programs. The dangers of prolonged use of hand-held devices that lead to Text Neck Syndrome may have multifactorial consequences in the development of young and adolescents.

What Is Already Known on This Topic:

Text Neck Syndrome is a modern epidemic affecting children and adolescents. It is a complex syndrome that is exacerbated by erroneous use of personal computers and cell phones in a poor position. Numerous potentially modifiable risk factors contribute to the development of the syndrome.

What This Study Adds:

This article provides an up-to-date summary of the key points regarding text neck syndrome, and highlights its significance as it is a globally growing problem. To investigate the exact mechanisms and the etiopathogenesis responsible for this condition further, more studies are needed. Progressive studies could provide more data about the etiopathogenesis of the syndrome, and screening of the high-risk population could both help the early diagnosis and treatment, and show the incidence of the syndrome.

Authors' Contributions: Conception and design: RAT and TT; Acquisition, analysis and interpretation of data: RAT and DC; Drafting the article: RAT, DC and TT; Revising it critically for important intellectual content: TT; Approved final version of the manuscript: RAT, DC and TT.

Conflict of Interest: The authors declare that they have no conflict of interest.

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