

Assessment of Co-Morbid Factors Associated with Text-Neck Syndrome among Mobile Phone Users

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ABSTRACT

Objective: To assess the co-morbid factors associated with Text-neck syndrome among mobile phone users and also identify their severity.

Materials and Methods: 59 confirmed cases of Text-Neck syndrome within 18-25 years of age who use mobile phone on an average of about 3 or more than 3 hours in a day and having 3 out of 6 symptoms of Text-Neck were taken and Forward head posture, Grip strength, Active cervical joint ROM and Neck muscles' strength were assessed in them and the measurements were noted.

Results: 100% showed neck pain and Forward head posture while 94.91% with upper back pain, 89.83% with headache and poor grip strength and 59.32% with shoulder pain.

Conclusion: There are various co-morbid factors of Text-Neck syndrome out of which severity of Neck pain and upper back pain is more followed by headache, shoulder pain. Also Forward Head Posture is one of the main serious co-morbid factors. Along with that, cervical joint ROM mainly flexion, extension and lateral flexion (left and right both) are restricted. As stated above, smartphone induced neck pain and other co-morbid factors are of chronic, progressive nature, timely interpretation and interventions along with postural correction will be the key entities to deal with Text-Neck syndrome.

Keywords: Text Neck Syndrome, Forward Head Posture, Grip Strength

I. INTRODUCTION

Smartphones are becoming increasingly indispensable in everyday life and offer a substantial variety of mobile applications for information, communication, education and entertainment purposes. While mobile applications offer several ways to prevent and treat chronic diseases such as diabetes or alcoholism, there are also obvious adverse effects on physical and mental health caused by their overuse.¹ Recent investigations have shown that smartphone users tend to report pain in the neck, shoulder and thumb and the severity of the symptoms as the total time spent using the smartphone increases. Prolonged use causes faulty posture such as forward neck posture, slouched posture or rounded shoulders.² Regarding mental health, recent studies showed that increased

smartphone use might be related to sleep disturbances and depression.³

The weight of an adult's head in neutral position is 10-12 pounds. There is an increase in load towards the neck with the flexion of the head and the weight is calculated to be 27, 40, 49 and 60 pounds at 15°, 30°, 45° and 60° respectively. When using a smartphone, people usually have a downward gaze to stare at the lowered objects and maintain the head in a forward position for long periods of time which may cause neck pain. Moreover, the maintenance of a head-forward posture decrease cervical lordosis of the lower cervical vertebrae and creates a posterior curve in the upper thoracic vertebrae to maintain balance. This is known as Forward Head Posture/ Turtle Neck posture. This causes strain on the muscles, ligaments and joints

which leads to impingement of nerves resulting into tingling, numbness in the hands. Such increase in biodynamical stress followed by forward head posture becomes a cause of musculoskeletal problems such as neck pain, headache and temporomandibular dysfunction.⁴

The excessive usage of smartphones reported to have a negative influence on our anxiety and stress levels. Lack of proper sleep may lead to fatigue, tiredness and shortfall of energy during morning hours.⁵

A recent study shows that 79% of the population between the age 18-44 have their cell phones with them almost all the time, with only 2 hours of their walking day spend without their cell in hands.⁶ According to recent Times Of India survey, 82 million Indian Adults were smartphone users in 2014. Smartphone users in India usually spend an average of 3 hours a day on their smartphone while heavy smartphone users spend 8-10 hours in a day. (DurgeshNandanJha, July 23, 2014, 12:11 AM m.timesofindia.com)

“Text neck” is the term used to describe the neck pain and damage sustained from looking down at the cell phone, tablets or other wireless device too frequently and for too long. Most commonly it causes neck pain and soreness. In addition to it, upper back pain ranging from chronic, nagging pain to sharp and severe upper back muscles spasm, shoulder pain and tightness, possibly resulting in painful shoulder muscle spasm. The term “Text neck” was coined by Dr. Dean L. Fishman, who is a US chiropractor. This term is used to describe a repetitive stress injury or an overuse syndrome where a person has his/her head hung or flexed in a forward position and is bent down looking at his/her mobile for prolonged periods of time.

If text neck is left untreated, it can lead to some serious permanent damage, such as:

- Flattening of the spinal curve
- Onset of early arthritis
- Spinal misalignment
- Disc compression
- Nerve damage
- Muscle damage
- GI problems
- Depression, stress
- Headaches⁶

The physical exposure when text messaging on a mobile phone consists of low physical load, repetitive thumb movements and neck flexion. The time spent using a mobile phone and its small keyboard for texting is likely to increase because of the increased multifunctionality of the smartphones and thus will increase the risk of Text neck and it's associated co-morbidities.⁷

II. MATERIALS AND METHODOLOGY

59 confirmed cases of Text-Neck syndrome in the age group of 18-25 yrs who use mobile on an average for about 3 or more than 3 hours in a day and having any 3 out of 6 symptoms of Text-Neck i.e. neck pain, upper back pain, shoulder pain, headache, insomnia, tingling, numbness in hands were included in the study. The analytical design study was conducted. Exclusion criteria were individuals who have any congenital, traumatic and surgical conditions of the cervical, thoracic spine and shoulder that alters Neck-shoulder complex, subjects diagnosed with migraine, tinnitus and any neurological condition leading to memory problems, depression and headaches. Materials such aspen, book, Hand grip dynamometer, Goniometer, mobile camera, Pressure Biofeedback were used for the assessment.

Permission was obtained from institutional ethical committee. Informed consent was taken from the individuals willing to participate as per the inclusion

and exclusion criteria and purpose of the study was explained to them and the samples were screened.

Procedure:

Demonstration room with adequate ventilation, proper light and plain coloured walls was chosen where the study was going to be carried out. Text neck samples were confirmed based on it's symptoms. Photographs of an each individual were taken in a sagittal plane with the help of mobile camera (13mp, resolution:4128×3096) to find out the **Forward Head Posture**. Forward Head Posture measurement in terms of angle was conducted with the photos by using ImageMeter application (Kinovea software).

The angle was calculated between the true horizontal line through the jaw and the spinous process of C7 and the line connecting both of them with the tragus of the ear. This angle was chosen as it is considered to be the clinical standard for measuring sagittal craniocervical posture, which refers to the degree of Forward head posture.

Grip strength of dominant and non-dominant hands of each sample was assessed with the help of Hand-grip dynamometer. In this, the sample holds the dynamometer in the hand to be tested, with the arm at right angles and elbow by the side of the body. The handle of the dynamometer is adjusted if required- the base should rest on first metacarpal

while the handle should rest on middle of four fingers. When ready, the sample squeezes the dynamometer with maximum isometric effort, which is maintained for about 5 seconds. No other body movement is allowed. Recordings in kgs were noted for each sample.

Active Cervical joint ROM of each sample was assessed by using Goniometer. Samples were in an upright sitting, looking straight ahead, arms resting on their lap and feet flat on the floor during all range of motion tests.

Neck muscles' strength was assessed with the help of Pressure Biofeedback and values were noted. Samples laid hook-lying position on a therapy table with a neutral neck position where their head and neck lined up and straight. The pressure cuff of the pressure biofeedback was placed underneath the occiput. Samples were instructed to tuck their chin gently as if saying 'yes' without using the neck motions which may substitute the sternocleidomastoid muscle. The testing range was from 20 mmHg to 30 mmHg and the pressure should maintain for 10 seconds in each 2mmHg without resting.

On the basis of samples, severity of co-morbid factors of Text neck was evaluated.

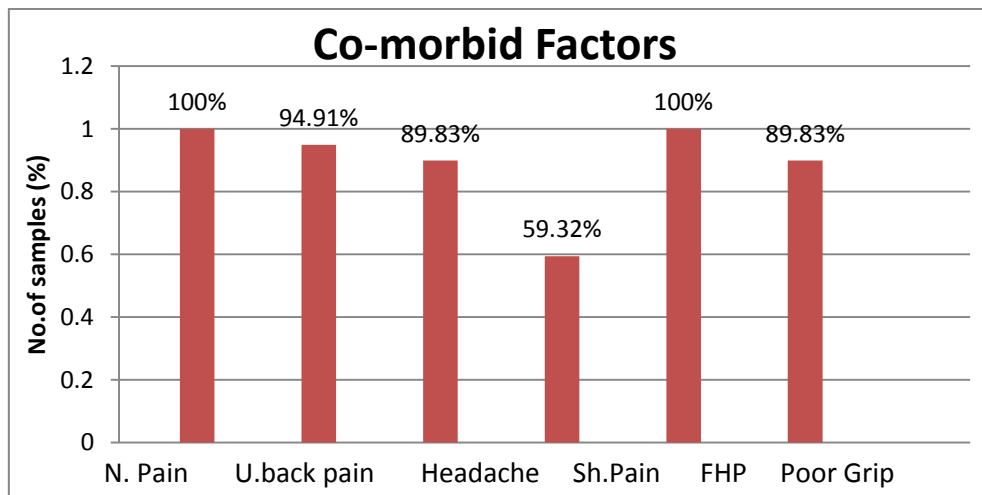
DATA ANALYSIS

Table 1

Age		Gender		Dominance	
Mean	SD	Female	Male	Right	Left
22.06	1.49	91.52%	8.47%	93.22%	6.77%

Table 2. Co-morbid Factors of Text-neck Syndrome

	Neck Pain	Upper back Pain	Headache	Shoulder pain	Forward Head Posture	Grip Strength
No. of samples (%)	100%	94.91%	89.83%	59.32%	100%	89.83%



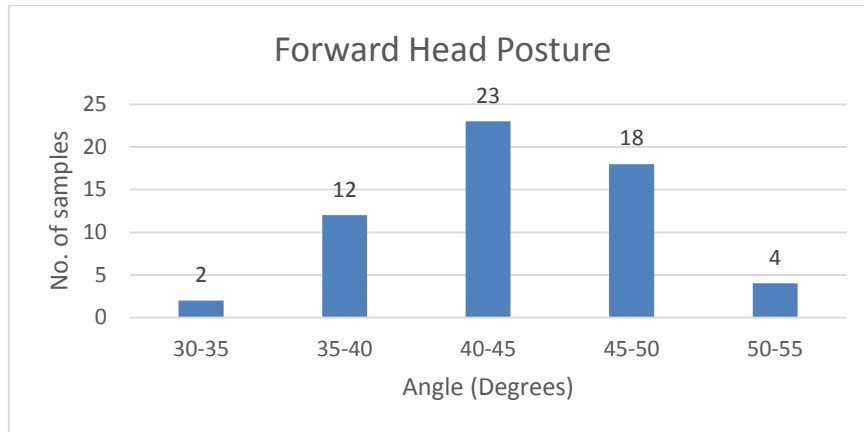
Graph 1

Interpretation : Graph 2 shows that there are 100% samples with neck pain and Forward head posture while 94.91% samples with upper back pain, 89.83% with headache and poor grip strength and 59.32% with shoulder pain.

Table 3. Severity of neck pain, upper back pain, shoulder pain and headache(VAS)

VAS	Neck Pain	Upper back Pain	Headache	Shoulder pain
Mean	5.27	4.79	3.91	2.10
Median	6	5	4	2
Mode	7	6	2	0

Interpretation : Table 3 shows that mean, median and mode of neck pain is 5.27, 6 and 7 resp. while that of upper back pain is 4.79, 5 and 6. Mean, median and mode of headache is 3.91, 4 and 2 while that of shoulder pain is 2.10, 2 and 0.



Graph 4. Forward Head Posture

Interpretation: Graph no.4 shows maximum no. of samples (23) having forward head posture in the range of 40°-45°.

Table 5. Grip Strength

Grip Strength	Females	Males
Poor	49	5
Below Average	4	0
Average	1	0

Interpretation : Table 5 shows that 49 females and 5 males having Poor Grip Strength while 4 females having below average strength.

Table 6. Cervical joint flexion ROM

Angle (Degrees)	No. Of samples
< Or =30	2
31-35	8
36-40	18
41-45	23
46-55	8

Interpretation: Table 6 shows maximum no. of samples (23) having cervical joint flexion ROM in the range of 41°-45°.

Table 7. Cervical joint Extension ROM

Angle (Degrees)	No. Of Samples
31-40	7
41-50	35
51-60	17

Interpretation: Table 7 shows maximum no. of samples (35) have cervical joint extension ROM in the range of 41°-50°.

Table 8. Cervical joint Lateral flexion (Left and Right) ROM

Angle (Degrees)	Left (No. of samples)	Right (No. of samples)
<45	59	58
>=45	0	1

Interpretation: Table 8 shows maximum no. of samples have cervical joint lateral flexion ROM (Left and Right) < 45° i.e. restricted than normal.

Table 9. Cervical joint Lateral Rotation (Left and Right) ROM

Angle (Degrees)	Left (No. of samples)	Right (No. of samples)
<70	29	22
>=70	30	37

Interpretation: Table 9 shows maximum no. of samples have cervical joint lateral rotation (left and right) ROM > or =70° i.e. within normal range.

Table 10. Deep Cervical Flexors' strength

DCF strength (mm of hg)	No. Of samples
20-25	11
25-30	39
30-35	9

Interpretation: Table 10 shows maximum no. of samples (39) have Deep Cervical Flexors' strength in the range of 25-30 mm of hg.

Table 5 shows that 49 females and 5 males have Poor Grip Strength while 4 females have below average strength with only 1 female having average grip strength.

III. RESULTS

Table 1 shows that mean and SD of age are 22.06 and +/- 1.49 respectively. Also 91.52% are females and 8.74% are males. Right side dominance is 93.22% while left side is 6.77%.

Graph no. 2 shows that there are 100% samples with neck pain and Forward head posture while 94.91% samples with upper back pain, 89.83% with headache and poor grip strength and 59.32% with shoulder pain. Table 3 shows that mean, median and mode of neck pain is 5.27, 6 and 7 resp. while that of upper back pain is 4.79, 5 and 6 followed by headache i.e. 3.91, 4 and 2 resp. and then shoulder pain i.e. 2.10, 2 and 0.

Graph no. 4 shows that 23 samples with Text-Neck syndrome have Forward Head Posture in the range of 40°-45° while only 2 samples have Forward Head Posture in the range of 30°-35°.

Table 6 shows 23 samples with Text-Neck syndrome have cervical joint flexion ROM in the range of 41°-45° while only 2 samples in the range of <=30°.

Table 7 shows that 35 samples with Text-Neck syndrome have cervical joint extension ROM in the range of 41°-50° while only 7 samples in the range of 31°-40°.

Table 8 shows that 59 and 58 samples of Text-Neck syndrome have cervical joint lateral flexion ROM (Left and Right resp.) < 45° i.e. restricted than normal.

Table 9 shows that 30 out of 59 samples with Text-Neck syndrome have Left Cervical joint lateral rotation ROM > or =70° while 37 out of 59 samples have Right cervical joint lateral rotation ROM > or =70° i.e. within normal range.

Table 10 shows that 39 samples with Text-Neck syndrome have Deep Cervical Flexors' strength in the range of 25-30 mm of hg

IV. DISCUSSION

The purpose of the study was to assess the co-morbid factors associated with Text-Neck syndrome and identify their severity. After screening of 300 samples, 59 samples were selected having symptoms of Text-neck syndrome. In this study, participants who used their smartphone every day and almost for more than 3 hours in a day on an average were included. In this study, the mean age of the samples is 22.06 years \pm 1.49 with 91.52% females and 8.47% males. Also, right sided dominance was 93.22% while left sided was 6.77%.

Present study shows that there are 100% samples with neck pain and Forward head posture while 94.91% samples with upper back pain, 89.83% with headache and poor grip strength and 59.32% with shoulder pain. Studies on the prevalence of smartphone use have reported that the distribution of musculoskeletal symptoms or pain of any severity was most common in the neck, followed by the upper back and then the shoulders.⁶ This study shows that severity of neck pain among Text-neck syndrome patients is more followed by upper back, headache and then shoulder pain (Mean, median and mode of neck pain=5.27, 6 and 7 resp. while that of upper back pain is 4.79, 5 and 6 followed by headache i.e.3.91, 4 and 2 resp. and then shoulder pain i.e. 2.10, 2 and 0). Thus, Neck pain is the prominent symptom seen in the Text-Neck syndrome patients followed by upper back pain.

Present study shows that all 59 samples have Forward Head Posture as all have FHP more than 10°(Normal value).¹² Out of 59, 23 and 18 Text-Neck syndrome samples are severely affected as they have Forward Head Posture angle in the range of 40°-45° and 45°-50°. Lemola S. et al. noted that the most common condition that contributes to neck pain is Forward

head and shoulder posture. In regards to Forward Head Posture, the head is shifted in front of the anatomical gravity midline and the head is rotated towards the back in an attempt to have straight sight under such posture.³ This causes an excessive anterior curve in the lower cervical vertebrae and an excessive posterior curve in the upper thoracic vertebrae to maintain balance and place stresses on the cervical spine and neck muscles. Previous article has found that the head flexion angle was larger when text messaging compared with web browsing and video watching.² Thus, excessive head flexion causing Forward Head Posture and protracted shoulders impose risk among heavy smartphone users.

In this study, grip strength of both the hands was assessed and result shows that 49 females and 5 males have Poor Grip Strength while 4 females have below average strength with only 1 female having average grip strength.¹³ While texting on mobile phone, the hand and fingers are highly exposed to repetitive movements. EwaGustafsson et al. found differences in texting velocity between men and women, with women texting with higher velocity.⁷ This can result into wrist and thumb pain associated with below average to poor grip strength. And grip strength is essential to perform functional activities. Thus, Text-Neck syndrome can cause loss of grip strength and ultimately, loss of ability to perform functional activities.

Prolonged shearing of the vertebrae from Forward Head Posture eventually irritates the small facet cervical joints as well as soft tissues and ligaments. This irritation causing neck and upper back pain will also lead to trigger points in the trapezius, sternocleidomastoid and rhomboids muscles, along with limited cervical joint Range Of Motion.¹ When assessed Cervical Joint ROM, 23 Text-Neck syndrome samples have flexion in the range of 41°-45°, followed by 18 samples in the range of 36°-40° i.e restricted (normal range:0°-80°) . Also, extension was found out

to be in the range of 41°-50° by 35 patients i.e. also restricted (normal range: 0°-70°). 59 samples with Text-Neck syndrome and 58 samples have cervical joint lateral flexion ROM (Left and Right resp.) < 45° i.e. restricted than normal. (normal range: 0°-45°). 30 out of 59 samples with Text-Neck syndrome have Left Cervical joint lateral rotation ROM > or = 70° while 37 out of 59 samples have Right cervical joint lateral rotation ROM > or = 70° i.e. within normal range (normal range: 0°-70°)¹⁴. So, present study shows that cervical flexion, extension and lateral flexion (Left and Right) ROM are restricted in individuals having Text-neck syndrome. People are using smartphone not only in sitting and standing but also lying on prone and side lying. Further, people use their smartphone with one hand often with tilted head due to the size of the equipment. It may cause excessive stress on the related structures that the more use of a smartphone could possibly result into reduced lateral flexion of the neck.¹¹ Due to hypomobility of cervical joints, chronic neck pain and ultimately spinal degeneration will occur at an early age.¹

Deep Cervical Flexor Muscle strength was found to be in the range of 25-30mm of hg by maximum no. of samples i.e. 39 patients. However, we don't have standardized normal values for the Deep Cervical Flexors' strength which is measured with the help of pressure biofeedback. SeverinHaug et al. stated that due to continuous load on the upper cervical and lower thoracic vertebrae which causes neck and upper back pain, muscles like trapezius, rhomboids, sternocleidomastoid, deep cervical flexors are the main to go for weakness.¹ Forward Head Posture can result in adaptive shortening of the occipital muscles. It also causes the cervical spine to change alignment resulting in increased stress of the facet joints and posterior discs and other posterior elements. This position may lead to weakness of Deep Cervical Flexors. Janda described a cervical "Upper Crossed Syndrome" to show the effect of forward head posture on the muscles. With this syndrome, the deep cervical

flexors as well as rhomboids, serratus anterior and often the lower trapezius are weak. Opposite these weak muscles are tight pectoralis major and minor, along with upper trapezius and levator scapulae.¹⁴

The use of a smartphone- a small, electronic, handheld device causes these musculoskeletal impairments which lead to permanent damage of the joints, soft tissues and ligaments in young age. Hence, the modification of lifestyle to alleviate the muscular pain and discomfort of text neck is essential before the condition worsens. Taking frequent breaks from texting, doing stretching exercises of neck, posture focused exercises such as chin tucks, Pilates and Yoga to improve posture will prevent the young population from this addictive and disabling syndrome and also proper ergonomics for how the mobile phones should be used will increase awareness among young population.

V. CONCLUSION

Present study concludes that there are various co-morbid factors of Text-Neck syndrome out of which severity of Neck pain and upper back pain is more followed by headache, shoulder pain. Also Forward Head Posture is one of the main serious co-morbid factors. Along with that, cervical joint ROM mainly flexion, extension and lateral flexion (left and right both) are restricted.

As stated above, smartphone induced neck pain and other co-morbid factors are of chronic, progressive nature, timely interpretation and interventions along with postural correction will be the key entities to deal with Text-Neck syndrome.

LIMITATIONS

1. Small sample size used in the study.
2. Study was conducted in limited area.
3. Wrist and thumb pain were not assessed.

VI. FUTURE SCOPE

As Text-Neck syndrome is a repetitive stress injury, further studies can be done on the effectiveness of treatment protocol in Text-Neck syndrome and also to check whether this condition is reversible or not.

Also, as normal standardized values for Deep Cervical Flexors' strength which is taken with the help of pressure biofeedback are not known, further studies can be done on finding out the normative data for it.

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