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ORIGINAL ARTICLE

EFFECTIVENESS OF SNAG AND DEEP NECK FLEXORS STRENGTHENING EXERCISE ON PAIN, DISABILITY AND FORWARD HEAD POSTURE IN TEXT NECK SYNDROME

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ABSTRACT

Background: Neck pain is a common musculoskeletal condition in our modern society. Neck is responsible for supporting the weight of the head. In recent time, the advancement in Mobile technology has lead to more people who spent their time using Smart phone, Laptop, e-reading &social media. The combination of repetitive movements, poor posture, and overuse of phones without taking breaks can cause overuse syndrome, repetitive stress injuries. **Methodology:** Pre- and post-study design with a sample size of 30 subjects with Text Neck Syndrome were selected based on inclusion criteria. They were randomly allocated into 2 groups. Experimental was treated with Sustained natural apophyseal glide (SNAG), Deep neck flexors (DNF) Strengthening & Postural correction, Control group was treated with postural correction only. Subjects were treated in 3 sessions per week for a period of 6 weeks. Neck disability index, cranio vertebral measurement using Kinovea software was measured at baseline and 6 weeks after intervention. The result was analyzed statistically. **Result:** Pain, disability and forward head posture scores significantly improved in both groups. Experimental group shows greater improvement in pain, disability and forward head posture than control group in subjects with Text neck syndrome. **Conclusion:** SNAG and DNF strengthening is effective in improving pain, disability and forward head posture.

Keywords: Text neck syndrome, SNAG, Deep neck flexors strengthening, Postural correction, Forward head posture.

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INTRODUCTION

Bony portion of the neck is called cervical spine. It is a complex structure made up of many bones, muscles, nerves, blood vessels, lymphatic's, and other connective tissue.

Text neck syndrome is a growing health concern and has the potential to affect millions of people all over the world. Computer technology has significantly dominated people's modern lifestyle. The term "TEXT NECK" was coined by Dr. Dean L Fishman, who is a chiropractor. It can be described as repetitive stress injury, and excessive watching or texting for prolonged time. When keeping the handheld mobile devices below the line of sight causes forward head posture and decreased cervical lordosis, forming the posture named as text neck. Text neck may cause harmful symptoms such as neck pain, shoulder pain, upper back pain, and chronic headache[1].

It is anticipated that there will be 815.2 million mobile phone users in India overall by the year 2020. In a study of college students United states – textual content messaging emerged as most often used form of communication medium, 79% of the population between the ages of 18-44 have their smart phone with them nearly all time[2].

Adolescent age group are more addicted to smart phone usage, especially young people spend an average of 5 to 7 hours per day more likely on social media, academic search, communication, and entertainment with their head in wrong position. Gustafsson et.al found a relationship between text messaging and the neck/ upper back pain. Prolong use results in adverse anatomical, biomechanical changes in cervical, thoracic spine, like loss of c shaped cervical spine, thoracic Kyphosis, postural compensation and muscular imbalances. Such a de arrangement may cause homeostasis which controls the blood supply and metabolites in the muscles and it can result in significant pain and loss of function[3].

Forward head posture is characterized by lower cervical flexion and upper cervical extension that leads to anterior deviation of neck from neutral to maintain the eyes at horizontal. Excessive upper cervical extension results in decreased atlanto occipital and atlanto axial joint space thus an increase in posterior compressive force occurs. Harrison et.al found that the compressive load on cervical disc in forward head posture was 10kg greater than that in the upright neck position. These biomechanical variations induce proprioceptive defects and neck pain.

Flexed neck posture increases the moment arm of cervical spine and leads to muscle strain. This shortens the sub occipital muscle, slackens posterior ligamentous structures cause irritation or compression of vertebral artery or greater occipital nerve[4]. When the ears forward head posture directly affects the spine while flexing the head forward at varying degrees -when the head tilts forward at 15 degrees, the forces on the neck surge to 27 pounds, at 30 degrees 40 pounds, at 45 degrees 49 pounds and at 60 degrees 60 pounds[5].

The Deep neck flexors are small stabilizing muscles, longus capitis and longus colli muscles located on the anterior and anterior-lateral surfaces of the cervical spine and are deep to the sternocleido mastoid muscle. Researchers have reported that the longus colli and muscles located on the posterior of the neck form a sleeve that stabilize the cervical spine in

all positions against the effects of gravity. Therefore, if muscle recruitment is impaired cause improper alignment of spinal segment and posture that could lead to cervical pain. Fixing the cervical area while using moderate endurance rather than producing high levels of motility to maintain the head weight throughout its movement in diverse directions[6].

Mulligan's mobilization in the form of SNAGS, the concept has its foundation built on Kaltenborn's principles of restoring the accessory component of physiological joint movement. According to Hearn and Rivett, (2002) fundamental mechanism of the effect of cervical SNAGs seems likely to be either purely mechanical, reflexogenic or a combination of the two.. The other mechanism such as in the gate control theory. In addition, descending pain-inhibitory systems may be activated, the end range positioning in movement with the SNAG may engage these inhibitory systems and reduce pain and disability[7].

NDI is a reliable, comprehensively validated and clinically useful tool to measure disability due to neck pain, NDI is a ten-item questionnaire. there are 4 items that relate to subjective symptomatology (pain intensity, headache, concentration sleeping) and 6 items that relate to ADL (lifting, work, driving, recreation, personal care, reading, recreation, personal care). Vernon and Mior (1991) proposed that a score of less than 4 indicate no disability, 5-14 mild disability, 15 – 24 moderate disabilities, 25 – 34 severe disability and scores greater than 35 complete disabilities[8].

The SAS is a self- reporting scale to assess the Smartphone addiction with a 6-point Likert scale (1: strongly disagree to 6 strongly agree)- 6 factors were daily – life disturbance, positive anticipation, withdrawal, cyberspace – orientated relationship, overuse and tolerance, higher the score, greater the degree of pathological use of smartphone[9].

METHODOLOGY

Procedure: This study was designed as randomized controlled study. Young adult age between the ages of 18 and 25 (males and female), Self-reported addiction to Smartphone score above 34, Using Smartphone continuously more than 2 hours, Usage of Smart phone, tablet and laptop for more than 2 years, Forward Head Posture – CVA lesser than 49.9˚, Neck disability index score ≥22%, having pain around the neck and shoulder and willing to participate were included. Subjects with Previous neck- head trauma, surgical intervention in neck area, congenital abnormalities, Degenerative disease, disc herniation, canal stenosis, Cervical inflammatory disease, Malignancy were excluded. 30 subjects met with Text Neck Syndrome were included in the study. Informed consent was obtained from them. The subjects were screened according to smart phone addiction scale short version. They were randomly allocated into 2 groups with 15 subjects in each group, i.e., Group A (experimental n = 15) and Group B (controln = 15) using Fish bowl method. The Physiotherapist who was assessed the patients blindly to the group allocation. Another physiotherapist applied exercise programmes to both groups.

After a brief demonstration about exercise, Group A (experimental) subjects were treated with SNAG, DNF Strengthening & Postural correction, Group B (control) subjects were

treated with postural correction only. Subjects were treated in 3 days per week for a period of 6 weeks with one session per day. Pre & Post test was conducted on neck disability index questionnaire for pain and disability and Kinovea software for forward head posture (craniovertebral angle) in both Group A & Group B. The results were recorded and analyzed statistically using SPSS 29.

Deep Neck Flexors Strengthening Exercise

Group A Patients were assigned to received deep neck flexors strengthening combined with SNAG and postural correction for 18 treatment session (three sessions per week) for 6 weeks.

Stage 1: Therapist position was at the side of the patient. Patient was asked to lie in a supine position with knee comfortably bent and placed a small rolled towel under the head. Patient was instructed to perform a small nodding movement that is look towards his or her toe without protrusion of the chin. The patient should maintain this position for 10 seconds after that return back to starting position. (FIG.1)

Stage 2: Therapist position was at the side of the patient. Patient was asked to lie in supine lying with knee comfortably bent. Patient was asked to perform a small nodding movement without protrusion of chin. The patient should maintain this position for 10 seconds after that return back to starting position. (FIG.2)

Stage 3: Therapist position was at the side of the couch. Patient was instructed to lie in a prone position with the head positioned out of couch and instructed to tuck his or her chin. The patient should maintain this position for 10 seconds then come back to starting position. (FIG.3)

FIG :1 Deep neck flexors strengthening

FIG: 2 Deep neck flexors strengthening

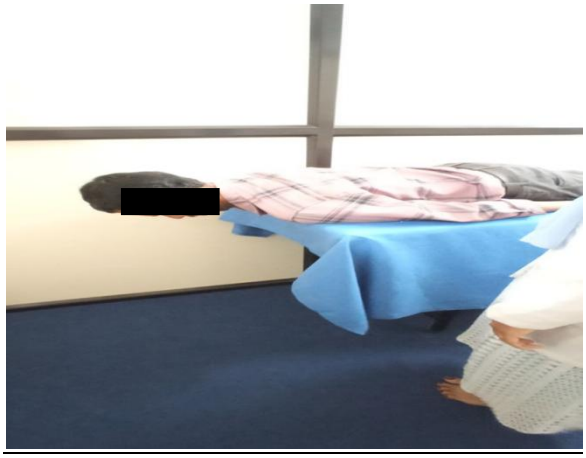

FIG 3: Deep neck flexors exercise

SNAG

In this technique the patient was seated on back support chair while the therapist stands behind the patient. The therapist applied a force to the spinous process in the upper side of the fixed joint with the right-hand thumb. and applied a passive antero-superior accessory gliding exercise while the left thumb was placed with the right thumb. The patient was instructed to do cervical flexion with gliding exercise of the cervical SNAG then return back to normal. Same like flexion patient instructed to do extension actively with cervical SNAG for extension and returning back to the neutral. The passive gliding exercise maintained in the anterosuperior direction along the line of the articular surface of the facet joint.

Group A, Experimental group assigned to receive this treatment session. Mulligan SNAGs was given to each cervical movement six repetition ×one set/session ×three sessions/week[10]. (FIG.4)

FIG: 4 SNAG

Posture correction

Exercise	Instruction
Shoulder or scapular retraction strengthening (FIG.5)	Standing or sitting, pull the shoulder blades together and inferiorly and hold for 10 seconds thereafter relax
Diaphragmatic breathing (FIG.6)	Instruct the patients to position one hand on the upper chest and the other one on the area below the ribs while seated. simultaneously take deep breaths in and out through the nose, causing the stomach to expand against the palm. Hold the breath for 10 sec. and breathe out. Keep the hand as still as possible on the upper chest. Repeat 10 times.
Chin tuck exercise (FIG.7)	The chin and head should be pulled straight back while seated until he/she feels a good stretch at the top of the neck and the base of the head. Hold for ten seconds, then relax and bring the head forward. Repeat it ten times.
Cervical stabilization (FIG.8)	perform a nodding movement without lifting the head off the bed and push the head gently back to the surface

	while in supine position. Hold for ten seconds and relax.
Pectoral stretching (FIG.9)	Instruct the patient to stand in an open doorway or corner with both hands slightly above your head on door frame or wall. Then slowly lean forward until he/she feels a stretch in the front of shoulders. Hold for ten seconds.
Levator scapula stretch (FIG.10)	Pull your head slowly downward while placing your right hand on top of your head until you feel a gentle stretch without pain along the left side of your neck. The position should kept for **20 to 30 seconds**.
Neck rotation exercise (FIG.11&FIG.12)	Lie on the floor with any thick hard material under your head such as phone book then slowly turn your head from side to side, holding position for 10 to 30 seconds on each side

Table 1 (Posture correction exercise)

Posture advices:

1. Always hold your electronic devices such as cell phone, computer, tab etc.at eye level.
2. Ensure to take 20 minutes breaks during usage of electronic devices.
3. Prolonged typing and scrolling of the screen should be avoided.
4. Holding the devices equally in both hands is mandatory.

FIG: 5 Scapula retractions strengthening, **FIG: 6** Diaphragmatic breathing, **FIG: 7** Chin tuck exercise



FIG: 8 Cervical stabilisation, **FIG: 9** Pectoral stretching, **FIG: 10** Levator scapulae stretch


FIG: 11 1Neck left rotation, **FIG :12** Neck right rotation

Outcome Measures

Neck Disability Index

The Interpretation of the obtained score is performed in percentages. On a vertical scale of 0 to 5, questions are scored. Total scores and multiply by 2. Divide by number of sections answered multiply by 10. A Score of 22% or more is considered significant activities of daily living disability.

(Score _ ×2) / (_ sections×10) =……. % ADL…….

Cranio vertebral Angle Measurement

CVA is the angle between the imaginary line extending from C7 through the tragus, and the horizontal line. If the FHP is greater, the CVA will smaller. The craniovertebral angle was measured by Kinovea software. The examiner stands at the side of the participant, marks the spinous process of 7th vertebrae done by using flexion extension movement and Targus, using adhesive double-sided tapes. Camera was placed 2 meters away from the lateral border of the footmark. Height of the camera was adjusted. Focus point should be Targus of the participant. At the analysis part the taken photographs were transferred into kinovea software[11].

RESULT

Gender wise Distribution of Subjects between Groups

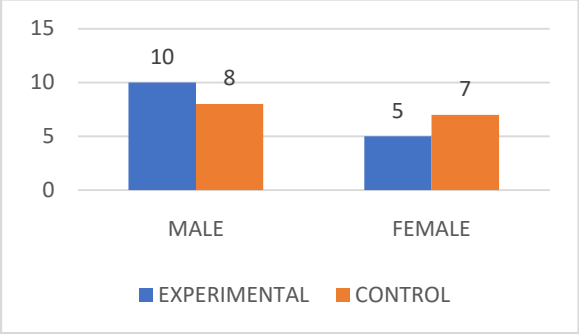

FIG: 13 Gender wise distribution of subjects between group

Age Wise Distribution of Subjects between Groups

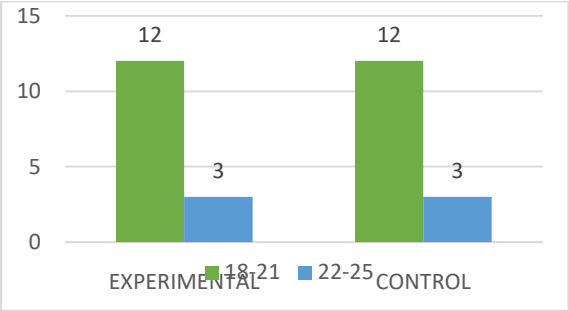

FIG: 14 Age wise distribution between groups

Comparison of Pre-Test Vs Post-Test Scores Of Neck Disability Index in Experimental Group (Group A)

NDI (%)	No. of Samples	Median	Inter Quartile Range (IQR)	Mean Rank	Sum of Ranks	Z value	*P* value*
Pre test	15	26	22-28	8	120	-3.426	<.001
Post test	15	2	2-4				

Table: 2 Analyzed by Wilcoxon signed ranks test

Comparison of Pre-Test Vs Post-Test Scores Of Neck Disability Index In Control Group (Group B)

NDI (%)	No. of Samples	Median	Inter Quartile Range (IQR)	Mean Rank	Sum of Ranks	Z value	*P* value*
Pre test	15	22	22-26	8	120	-3.436	<.001
Post test	15	4	4-8				

Table: 3 Analyzed by Wilcoxon signed ranks test, NDI Neck disability index

Comparison Of Pre-Test Vs Post-Test Score Of NDI Between Experimental Group And Control Group

NDI (%)		No. ofSamples	Median (Inter Quartile Range)	Mean Rank	Sum of Ranks	*U* value	*Z* value	*P* value*
TimePoint	Group							
Pre	Exp	15	26 (22-28)	16	240.00	105.00	-.320	.749
	Con	15	22 (22-26)	15	225.00			
Post	Exp	15	2 (2-4)	10.3	154.50	34.50	-3.370	<.001
	Con	15	4 (4-8)	20.7	310.50			

Table: 4 Analyzed by Mann-Whitney U test, Exp=Experimental group, Con =Control group, NDI = Neck disability index.

Comparison of Pre- Test Vs Post -Test Scores Of Cranio-vertebral Angle (CVA) In Experimental Group (GROUP A)

CVA (Degree)	No. of Samples	Median	Inter Quartile Range (IQR)	Mean Rank	Sum of Ranks	Z value	*P* value*
Pre test	15	41.1	31.2-42.1	8.00	120.00	-3.41	<.001
Post test	15	46.7	40-53.6				

Table: 5 Analysed by Wilcoxon signed ranks test, CVA = Craniovertebral angle

Comparison of Pre-Test Vs Post-Test Scores Of Cranio-vertebral Angle (Cva) In Control Group (GROUP B)

CVA (Degree)	No. of Samples	Median	Inter Quartile Range (IQR)	Mean Rank	Sum of Ranks	Z value	*P* value*
Pre test	15	35.5	31.8-41.2	8.00	120.00	-3.41	<.001
Post test	15	37.0	34.4-42.6				

Table: 6 Analyzed by Wilcoxon signed ranks test, CVA = Craniovertebral angle.

Comparison of Pre-Test Vs Post-Test Score Of CVA between Experimental Group and Control Group

CVA (Degree)		No. ofSamples	Median (Inter Quartile Range)	Mean Rank	Sum of Ranks	*U* value	*Z* value	*P* value*
Time Point	Group							
Pre	Exp	15	41 (31.2-42.1)	17.27	259.00	86.00	-1.09	.27
	Con	15	35.5 (31.8-41.2)	13.73	206.00			
Post	Exp	15	46.7 (40.0-53.6)	19.57	293.50	51.50	-2.53	.01
	Con	15	37 (34.4-42.6)	11.43	171.50			

Table: 7 Analyzed by Mann-Whitney U test, Exp=Experimental group, Con =Control group, CVA = Craniovertebral angle

DISCUSSION

The purpose of the study was to determine effectiveness of SNAG and deep neck flexors strengthening exercise on pain, disability and forward head posture in text neck syndrome. Based on the inclusion criteria, 30 subjects with Text Neck Syndrome were included in the study after signing an informed consent. The subjects were screened according to smart phone addiction scale short version. They were randomly allocated into 2 groups with 15 subjects in each group. Wilcoxon signed-rank test and Mann Whitney U test were used as statistical tools to reach a conclusion.

Numerous daily tasks could be completed using a Smartphone. Prevalence of Smartphone usage is increases drastically because of its portability, lightness, simplicity, and fast information processing ability. The Smartphone users' rate from 2016 -2020 increased from 3.6 to 6.5 billion. Maintaining static posture and repetitive task are the two main risk factors for musculoskeletal disorder[12].

Evidence shows that prolonged use of electronic device causes postural distortion in the pattern involving the head and neck. Forward head posture characterized by head protruded forward, the Tragus of the ear shift forward in relation to the shoulders coronal level.

Based on the statistical analysis comparison of pre and post- test values of NDI between experimental group and control group. The pre- test values of experimental group were, Median (inter quartile range) 26 (22-28), mean rank 16, sum of ranks 240.00. The pre- test values of control group were, Median (inter quartile range) 22(22-26), mean rank 15, sum or ranks 225.00. The pre -test Mann-Whitney *U* value was 105.00, *Z* value was -.320, *P* value was .749 which shows that there is no significant difference in pre -test values of NDI between experimental and control groups.

The post -test values of experimental group were, median (inter quartile range) 2(2-4), mean rank 10.3, sum of ranks 154.40. The post- test values of control group were, median (inter quartile range)4 (4-8), mean rank 20.7, sum of ranks 310.50. The post -test Mann-Whitney *U* value was 34.50, *Z* value was -3.370; *P* value was < .001 which shows that there is a statistically significant difference in post-test values NDI between experimental and control groups. Also the result shows that post -test value NDI in experimental group is lower than the post- test value of NDI in control group. And also, Study shows the comparison of pre and post- test values of CVA between experimental group and control group. The pre -test values of experimental group were, Median (inter quartile range) 41(31.2-41.2), mean rank 17.27, sum of ranks 259.00. The pre -test values of control group were, Median (inter quartile range) 35.5 (31.8-41.2), mean rank 13.73, sum or ranks 206.00.

The pre-test Mann-Whitney *U* value was 86.00, *Z* value was -1.09, *P* value was .27 which shows that there is no significant difference in pre-test values of CVA experimental and control groups. The post-test values of experimental group were, median (inter quartile range) 46.7(40.0-53.6), mean rank 19.57, sum of ranks 293.50. The post- test values of control group were, median (inter quartile range)37(34.4-42.6), mean rank 19.57, sum of ranks 171.50. The post-test Mann-Whitney *U* value was 51.50, *Z* value was -2.53; *P* value was <0.05 which shows that there is a statistically significant difference in post-test values of CVA between experimental and control groups. Also, the result shows that post -test value of CVA in experimental group is higher than the post- test value of CVA in control group. Therefore, the study rejects the null hypothesis and accepts the alternate hypothesis.

The Mulligan's SNAGs that may cause further sedation and nociceptive pain receptors inhibition also, can stretch and stimulate the mechanoreceptors present in the facet joint capsule and also end range overpressure done with SNAGs technique can stimulate the mechanoreceptors which present in the ligaments and muscles. Jasmita et.al (2017) reported that a greater improvement in the NDI scores of participants in Mulligan groups, this helpful to the reduction in the level of pain and disability[13].

The mechanism behind the Deep neck flexors strengthening, the deep cervical muscles, are small stabilizing muscles located on the anterior and antero lateral surface of the cervical spine, longus colli and longus capitis, which provide physical support to the cervical

vertebral column which is considered an important element of neuromuscular control of the cervical spine and provide support the head weight during its movement in various directions and fixing the cervical region by low endurance than generating high level of mobility. Altered activation of the deep cervical flexor muscles is a feature of some neck pain disorders[7]. Therefore, to maintain a correct posture in the cervical region, deep neck flexors contribute in maintaining a balance between the head and the neck in the upper part and from the lowest portion between the back and the waist.

CONCLUSION

Based on the Statistical analysis, the present study showed that there is statistical difference in pain, disability, and Forward head posture between pre-test and post-test in both experimental and control group. Experimental group showed a greater improvement in pain, disability while measuring NDI and Forward head posture while measuring CVA (Kinovea Software) than control group in subjects with Text neck syndrome. After analysing the study, the following conclusion was drawn: SNAG & Deep neck flexors strengthening are effective in improving pain, disability, and Forward head posture in Text neck syndrome.

Therefore, the study rejects the null hypothesis and accepts the alternate hypothesis.

Ethical Clearance: Ethical clearance has obtained from Bethany Navajeevan College of Physiotherapy, Trivandrum, and Kerala, India. Ref.no. BNCPP/MSK/2021/05

Conflicts of Interest: There was no conflict of interest to conduct this study.

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