



To Study the Effects of Deep Neck Flexor Strengthening Exercises and McKenzie Neck Exercises on Smart Phone Users Suffering From Neck Pain: A Comparative Study

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Abstract: Smartphone has become an integral part of our lives, they generally have a small screen because of which it is more likely to induce a slouched posture creating a line of sight mostly below eye level, formulating an improper posture when used for a prolonged period of time, for example, forward head posture (FHP) leading to neck pain. The purpose of the study is to compare the effectiveness of Deep neck flexor strengthening exercises with that of McKenzie neck extension exercises on smartphone users suffering from neck pain. It is a comparative experimental study. This study included (N=40) subjects with neck pain within the age group of 25-45 years. They are randomly assigned into 2 groups (Group A and B). Group A had 20 (N=20) subjects who are treated with Deep neck flexor strengthening exercises, Group B had 20 (N=20) who are treated with McKenzie neck extension exercises. The subjects were given intervention 5 days a week for 6 weeks. For within-group analysis Paired sample t-test was used and to analyze between-group variables Independent sample t-test was done. Between DNF and McK groups no significant difference was found in NDI($p<1.18$) and SFMPQ($p <1.17$) while all outcome measures showed a significant difference in both DNF and McK groups($p=0.00$)within the groups The results indicated that although both the treatment techniques, DNF and McK are effective in alleviating the neck pain in Smartphone users in terms of decreasing pain intensity and increasing functional ability as there was a significant difference within the two groups, but there was no significant difference between the DNF and McK group in decreasing pain intensity, increasing functional ability

Key words: Smartphone, neck pain, Deep neck flexor exercises, McKenzie exercises

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I. INTRODUCTION

In today's generation the use of smartphones is a basic essential need. It is commonplace for smartphones to be used to access music, videos, and social network services(SNS) as well as to make and receive calls. Smartphones have become not only an example of modern high-tech equipment, but also a daily necessity. The teenagers use smartphone's more actively than adults, and are more prone to be addicted to smartphone^{1,2}. Regarding the age dependent prevalence of smartphone addiction, previous studies have reported that teenagers are more likely to be absorbed in digital media, and have a higher addiction rate than adults. Additionally, different national surveys revealed that smartphone addiction is twice more Prevalent among teenagers than adults. The number of cell phone users increases every Year.

I.I. CLASSIFICATION OF SMARTPHONE ADDICTION DISORDER

Addiction of Smartphone can be classified in two categories like Psychological disorders comprising of Sleep disorder, Aggressive or depressive symptoms, Dropping out of school, Antisocial personality disorder etc and Physiological disorder likes Dry eyes, Carpal tunnel syndrome, Migraine headache etc. Smartphones, contrasting computers, feature a small screen that is likely to induce a more slouched posture toward a line of sight below eye level. When used for a long time, a video terminal such as a smartphone formulate an improper posture for example, forward head posture (FHP) or neck pain due to Forward head posture (FHP) is a common neck disease in contemporary society, and it is caused by sitting at a desk for a long time². Long-term usage of the device leads to additional tension on tendons, muscles, and parametric tissue, which could result in visual display terminal (VDT) syndrome. The excessive use of visual display terminals such as smartphones for prolonged time can cause improper posture such as forward head posture³. Forward head posture is defined as a posture that adopts upper cervical extension and lower cervical flexion¹. The centre of gravity of that of the head in this posture is positioned at the front rather than at the vertebral body weight. Mobile device users frequently adopt prolonged forward head posture while looking down at the screens of mobile devices. 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^{4,5}. Maintaining a continuous posture leads to damage to the ligaments around the neck or lumbar .Such a posture is caused by muscle fatigue and decreased physical activity. As a result, the weakness of the respiratory muscle decreases the lung capacity and increases pain¹. Eventually, maintenance of a slouched head posture for a long time imposes stress on the musculature as well as skeletal changes that may cause the loss of the C-shaped curve in the cervical spine, which may start to curve forward instead¹. Such a disarrangement may cause homeostasis, which controls the blood supply and metabolites in the muscles, and it can result in significant pain and a loss of function. In addition forward head leads to increases in cervical lordosis and thoracic or lumbar kyphosis which causes round shoulders and decreases in vital capacity and thoracic cavity^{1,2}.The McKenzie approach, which has been commonly utilized in low back pain condition, may also be

employed in the treatment of mechanical neck pain. It is a popular technique used by physiotherapists as a management for mechanical low back pain and neck pain. It is said to be effective in correcting forward head posture. It can be said to be a progression of mechanical forces applied by or to a patient in such a way that a minimal amount of effort is utilized to effect a therapeutic change in the presenting mechanical syndrome⁶. The Deep neck flexors are small stabilizing muscles located on the anterior and anterior-lateral surfaces of the cervical spine and are deep to the sternocleidomastoid muscle. The deep neck flexor muscles are identified as the Longus capitis and Longus colli muscles^{6,7}. The location of deep neck flexor muscles suggest they play an important role in stabilizing the cervical spine. 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 gravity⁸. Therefore, if muscle recruitment is impaired the balance between the stabilizers on the front and back of the neck will be disrupted. This will cause loss of proper alignment of the spinal segments and a posture that could lead to cervical pain. 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 between the back and waist to the lower part⁸. In addition, to support the head weight during its movement in various directions, deep neck flexor's work together and play the role of providing stability by supporting and fixing the cervical region by using low endurance rather than generating high levels of motility^{8,9,10}. The purpose of the study is to compare the effectiveness of Deep neck flexor strengthening exercises with that of McKenzie neck extension exercises on smartphone users suffering from neck pain.

2. METHODOLOGY

Subjects suffering from neck pain due to smartphone use from Assam Downtown College OPD were approached with the proposal of the study. The subjects were screened according to the inclusion and exclusion criteria. Those fulfilling the criteria were explained in details about the study and a written informed consent, in their preferred language and obtained from the subjects willing to participate. The subjects were allocated to two different treatment groups, Group A (Deep neck flexor strengthening exercises) and Group B (McKenzie Exercises) by simple random sampling, consisting of 20 subjects each¹¹⁻¹². For each subject, demographic data was collected. The demographic data and baseline assessment/pre-intervention data of the outcome measures was taken. Then intervention was given according to the group for six weeks. After completing the therapeutic session of 6 weeks, post-intervention/final data of the outcome measures was taken.

2.I. INTERVENTION: ^{1,11,12,13}

GROUP A- were received a Deep neck flexor strengthening exercises program and postural advice. Exercise consist of 3 sets of exercises which were done to activate and to increase the strength of deep neck flexor muscles along with postural advice.

- Each exercises were performed for 2 sets of 10 repetition, with 10 seconds hold
- Treatment will be given 5 times a week
- A total of 30 treatment in 6 weeks

2.2. DEEP NECK FLEXOR EXERCISE ^{11,12}

2.3. Stage 1 Deep neck flexor exercise-(Fig-1)

Position of the therapist- At the side of the couch. Position of the patient- Supine lying. Technique- The patient will be asked to lie in a supine position with knee comfortably bent. Put a small rolled towel under the head. Then the patient will be instructed to perform a small nodding movement as if to look towards his or her toes and avoid protrusion of the chin. The patient maintains this position for 10 seconds and returns to the starting position.

2.4. Stage 2 Deep neck flexor exercise-(Fig- 2)



Fig. 1 Stage 1 Deep neck flexor exercise



Fig. 2 Stage 2 Deep neck flexor exercise



Fig.3 Stage 3 Deep neck flexor exercise

2.6. GROUP B

were received by McKenzie neck exercises with postural advice.

- Each exercises were performed for 2 sets of 10 repetition, with 10 seconds hold
- Treatment will be given 5 times a week
- A Total of 30 treatment in 6 weeks

2.7. McKenzie neck Exercises^{1,12,13}

Position of the therapist- At the side of the couch. Position of the patient- Supine lying. Technique- The patient will be instructed to lie in a supine position with knee comfortably bent. Subjects will be asked to perform small nodding movement while avoiding protrusion of chin. The subject maintains this position for 10 seconds and returns to the starting position.

2.5. Stage 3 Deep neck flexor exercise-(Fig-3)

Position of the therapist- At the side of the couch. Position of patient- Prone lying . Technique- The patient will be instructed to lie in a prone position, with the subjects head suspended off the end of the bed. Subject will be asked to tuck his chin and maintain this position for 10seconds.

2.8. Retraction with neck flexion exercise-(Fig. 4)

Subject will be asked to sit in sitting position. In the same position subject will be asked to retract or tuck his or her chin and maintain this position while slowly/ gently tilting his or her head forward. The subject maintains this position for 10 seconds and returns to starting position.

2.9. Retraction with neck extension exercise-(Fig. 5)

Subjects will be asked to sit in sitting positions . In the same position the subject will be asked to retract or tuck his or her chin and maintain this position while slowly/ gently tilting his or her head backward as if looking at the sky. The subject maintains this position for 10 seconds and returns to the starting position.

2.10. Retraction with neck lateral flexion exercise- (Fig. 6)

Subjects will be asked to sit in sitting positions . In the same position the subject will be asked to retractor tuck his or her

chin and maintain this position while slowly/ gently bending his/her head sideways. The subject maintains this position for 10 seconds and returns to the starting position.

2.11. Retraction with Neck rotation exercise-(Fig. 7)

Subject in sitting position. In the same position the subject will be asked to retract or tuck his or her chin and maintain this position while slowly/ gently turning his or her head as far as possible. The subjects maintain this position for 10 seconds and return to starting position.



Fig. 4 Retraction with neck flexion exercise



Fig.5 Retraction with neck extension exercise



Fig. 6 Retraction with neck lateral flexion exercise



Fig. 7 Retraction with Neck rotation exercise

3 STATISTICAL ANALYSIS

All analysis were obtained using SPSS version 22. demographic data of patient including sex, age, NDI score, SF-MCPQ score were descriptively summarised. An Alpha level of 0.05 was used to determine statistical significance. Paired-t test was performed to find out the

effectiveness of DNF strengthening exercises and McKenzie exercises in reducing pain and improving disability function in neck pain due to smart phone use. Independent sample T-test was carried out to compare DNF strengthening exercises and McKenzie neck exercises.

NDI QUESTIONNAIRE Within group analysis-

TABLE 1 Group analysis within groups of Group A and Group B for NDI Questionnaire

Outcome Measure	Group	Week	Mean \pm S.D.	Paired 't' test	Comment
NDI score	Group A	Week 0	41.2 \pm 4.021	0.000	Significant difference between week 0 and week 6.
		Week 6	34.95 \pm 3.790		
	Group B	Week 0	40.85 \pm 4.848	0.000	Significant difference between week 0 and week 6.
		Week 6	36.55 \pm 4.685		

Within the group mean difference on NDI score before and after treatment. The average pre-interventional i.e. week 0 NDI score in the group A was 41.2 ± 4.021 and in the group B was 40.85 ± 4.848 where as post-interventional i.e. week 6 the scores reduced to 34.95 ± 3.790 in the group A

and 36.55 ± 4.685 in the group B. There was statistically significant decrease in the functional disability post interventional for both the groups in the NDI questionnaire done by using paired 't' test

Between group analysis-

TABLE 2 Between groups analysis of group A and group B for NDI Questionnaire.

Outcome measure	Group	N	Mean \pm SD	T	df	Independent 't' test (two sample)	Comment
NDI Questionnaire	Group A (MFTr)	20	34.95 \pm 3.790		38	1.19	Insignificant difference between groups after treatment
NDI Questionnaire	Group B (MET)	20	36.55 \pm 4.685	-1.187	36.744	1.19	

The between group analysis for NDI score was done using Independent 't' test showed statistically less significant improvement of function in the group A (DNF) as compared to the group B (McK).

SF-MPQ PAIN SCORE

Within group analysis-

TABLE 3 Within groups analysis of group A & group B SF-MGPQ.

Outcome Measure	Group	Week	Mean \pm S.D.	Paired t test	Comment
SF-MPQ	Group A	Week 0	3.25 \pm 1.020	0.000	Significant difference between week 0 and week 6.
		Week 4	0.80 \pm 0.951		
SF-MPQ	Group B	Week 0	3.30 \pm 1.081	0.000	Significant difference between week 0 and week 6.
		Week 4	1.15 \pm 0.933		

The average pre-interventional i.e. week 0 SF-MPQ pain score in the group A was 3.25 ± 1.020 and in the group B was 3.30 ± 1.081 where as post-interventional i.e. week 6 the pain score decreased to 0.80 ± 0.951 in the group A and 1.15 ± 0.933

in the group B. Changes in the SF-MPQ pain score revealed highly statistically significant improvement in reduction of pain post-interventional for both the groups (p). This was done using a paired 't' test.

Between group analysis-

TABLE 4 Between groups analysis of group A and group B for SF-MPQ.						
Outcome measure	Group	N	Mean \pm SD	T	Df	Independent 't' test (two sample) Comment
SF-MPQ pain score	Group A (NDI)	20	0.80 \pm 0.951	38	1.17	Insignificant difference between groups after treatment
SF-MPQ pain score	Group B (McK)	20	1.15 \pm 0.933	-1.174	37.871	1.17

The between group analysis for SF-MPQ pain score was done using Independent 't' test showed statistically less significant reduction of pain in the group A (NDI) as compared to the group B (McK). The assumption of difference in the effects of Deep neck flexor strengthening exercises (group A) and McKenzie neck exercises (group B) In terms of reducing pain and improving function on smartphone users suffering from neck pain was tested by comparing SF-MPQ pain scale and NDI between the groups. The mean age of sample for both Group A and Group B are 31.13 ± 7.70 and 30.05 ± 6.81 respectively. There was no significant difference in mean age between the groups and showed homogeneity of the subjects in the two treatment groups. After the intervention considerable change was observed in the mean values of group A and group B from that of the baseline value (SF-MPQ pain scale and NDI). Statistical analysis revealed a significant reduction of pain and improvement of function in both groups. Paired 't' test was performed for within group analysis. The NDI showed significant differences in both group A, mean value = 34.95 ± 3.790 and group B, mean value = 36.55 ± 4.685 with a 'p' value of (0.00). The SF-MPQ similarly showed significant difference in both group A, mean value = 0.80 ± 0.951 and group B, mean value = 1.15 ± 0.933 with a 'p' value of (0.00). Independent 't' test was performed between group analysis. The NDI did not show a significant difference in post analysis of group A, mean value = 34.95 ± 3.790 and group B, mean value = 36.55 ± 4.685 with a 'p' value of 1.18. Similarly in SF-MPQ group A, mean value = 0.80 ± 0.951 and group B, mean value = 1.15 ± 0.933 did not show any significant difference with 'p' value of 1.17.

4. DISCUSSION

Various studies have been done using Deep neck flexor strengthening exercises for neck pain on smartphone users and have concluded that Deep neck flexor strengthening exercises are effective in relieving pain and improving disability on smartphone users suffering from neck pain^{12,11}. Studies have also been done using McKenzie intervention on smartphone users suffering from neck pain and the results have shown significant improvement in pain and disability. So far, there are limited studies done on the comparison between both techniques^{12,13}. Therefore this comparative study was conducted to study the effectiveness of DNF and McK techniques in the treatment of neck pain on smartphone users for six weeks in terms of reduction of pain using SF-MPQ pain Questionnaire and improvement in function using NDI. It was also intended to compare the effectiveness of DNF versus McK techniques. The age distribution of the groups showed the homogeneity of subjects. The results from the statistical analysis of the study supported the null hypothesis which stated that there was no significant difference between the effectiveness of DNF versus McK technique to reduce pain and improve function on smartphone users suffering from neck pain. The mean values

of data from the study indicate that both DNF and McK technique could be beneficial in the treatment of neck pain in smartphone users. There was statistically significant difference in the SF-MPQ pain score and NDI in both group A and group B from 'week 0' to 'week 6'. The between group comparison showed statistically no significant reduction of pain on SF-MPQ pain score and improvement of function in group A (DNF) as compare to group B (McK). Results of the present study revealed that there was minimum considerable effects of DNF (group A) in reduction of pain and improve function as compared to McK (group B) in terms of SF-MPQ pain score and NDI score in 6 weeks.

4.1. LIMITATION

- The results only show the short term effects of the intervention.
- The study didn't include long term follow up. Thus the result can't tell us about the effectiveness of both the interventions in the long term.

5. CONCLUSION

The results of the study states that within group analysis in both the treatment groups A and B showed significant differences in the Neck Disability Index and Short form Mc Gill pain questionnaire but, in between group analysis, the NDI and SFMPQ showed insignificant difference So, the study concludes that Deep neck flexor strengthening exercises and McKenzie neck exercises are effective physical therapy regimen for smartphone users suffering from neck pain. when the interventions are compared, both of them proved to be equally effective in relieving pain and improving function in the treatment of neck pain due to prolonged use of smart phone.

6. AUTHORS CONTRIBUTION

Buru Yana MPT Scholar Carried out the research work on field in data collection and did review of literature. Prepared the thesis as a part of the curriculum of Masters in Physiotherapy. Madhusmita Koch Assistant Prof. Physiotherapy Guided the scholar as a Co-guide in the study and guided in selection criteria along with review of literature.³Abhijit Kalita, Assistant Prof. Physiotherapy Contributed in the study in helping data collection Abhijit Dutta (Corresponding Author), Associate Prof., Associate Dean Faculty of Paramedical Sciences, Assam down town University Guided as the main supervisor/guide in the whole study along with methodology, result analysis, discussion of the study.

7. CONFLICT OF INTEREST

Conflict of interest declared none

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