Instant effects of neck met stretching and sustained natural apophyseal glides on pain, craniovertebral angle, and neck range of motion in intense smartphone users; A Pre-Posttest Quasi-Experimental Study

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ABSTRACT

Background: The Smartphone has become a necessity for most people. Smartphone are used for both communication and entertainment purposes, such as messages, music, media, internet access, photos, and games.[1]

Purpose: The aim of the study is to assess the "immediate effects of posterior neck MET stretching along with sustain natural apophyseal glide on pain CVA and neck ROM in subjects with heavy smart phone users."

Subjects & Method: 30 heavy mobile phone users with neck pain were included in this study. Subjects were assigned into two groups by inclusion & exclusion criteria (n=15 per group) Group A (apply MET stretching) & Group B (apply SNAG). Assessment has done - CVA through Surgimap smart phone application & through Surgimap system software**.** For pain measurement, Visual Analogue Scale (VAS) was used in individually).

Result: The present study found in within group for MET there was significant improvement in CVA, VAS and Cervical ROM. However, for SNAG group there was also significant improvement in CVA, VAS but no significant improvement in left and right rotation at cervical ROM. In between group, no statistical significant difference in CVA and VAS in between MET and SNAG groups.

Conclusion: In this present study it can be concluded that the SNAG Mulligan technique and MET stretching are effective in reducing pain, increasing CVA and improving cervical ROM in patients with mechanical neck pain, as there was no significant difference between the two groups.

Keyword: MET Stretching, SNAG, CVA, VAS.

INTRODUCTION

The Cell phone has turned into a need for a great many people. Cell phones are utilized for correspondence and amusement, for example, messages, music, media, web access, photographs, and games. WHO considers habit as "Reliance as the nonstop utilization of something for alleviation, solace or feeling, which frequently causes hankering when it is missing".

Worldwide, 5.1 billion individuals (67%) utilize a cell phone routinely. By 2020, it is projected that 90% of the populace will utilize a cell phone. The typical client burns through 3 hours a day to day on their cell phones. These screens are never situated at eye level, making the client take on an adjusted neck position for delayed timeframes, most likely instigating neck pain.

Alongside the expansion in the utilization of the Cell phone, the numbers of individuals who gripe of pain in the neck and furthest point (Berolo et al., 2011). Neck protests and agonies are the most often revealed side effects among Cell phone clients. As indicated by a methodical survey by Xie et. al. (2017), the pervasiveness of outer muscle grumblings among Cell phone clients goes from one percent to sixty eight percent and neck complaints have the most elevated predominance charge going from seventeen percent to sixty eight percent.

Additionally, Tonga et al. (2017), tracked down that the most continuous outer muscle side effects, experienced by Cell phone clients among college understudies, were tracked down in the neck (59.6%), shoulder (51.82%), and upper back areas (54.4%).

A past report expressed that FHP causes shortening of the strong filaments around the exclamation points of the atlanto-occipitalis and overextending of muscles around joints, potentially creating persistent neck pain. Unfortunately, stance brings about strange weight on joints and delicate tissues of the body and it is related to outer muscle distress.

The neck is the most well-known site of distress, with an event of 75.7% among the solid youthful grown-up populace and an upsurge in the previously mentioned condition can ultimately prompt neck pain. 3/4 of the populace experience neck pain no less than once in the course of their life as per writing with a year commonness of around 30%-50%. Cervical lordosis and forward head pose are contrarily corresponding to each other. [(5)] Sound youthful grown-ups with constant mechanical neck pain have an expanded forward head act and diminished cervical lordosis when contrasted with pain-free people.

MATERIAL & METHOD

STUDY DESIGN: The design of this study is pre and post experimental design.
STUDY SETUP: All Participants were taken from random places in Uttar Pradesh and West Bengal, India.
SAMPLE SIZE

Total 30 participants were selected on the basis of addition & elimination criteria & divided into two groups.

Group A, n=15 (applying MET stretching)

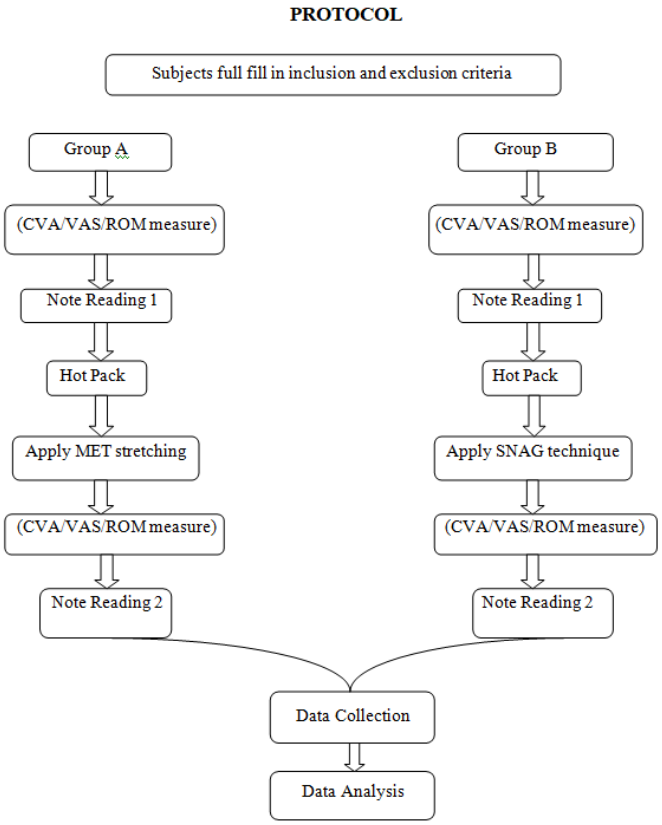
Group B, n=15 (applying SNAG)

SAMPLING METHOD

Total participants were matched according to the inclusion & exclusion criteria. The subjects were randomly assigned in group A & group B. Participant who satisfy & willing to participate were allowed in the study after explaining the procedure & filling the consent form.

STUDY DURATION: The duration of this study is 2 months.

PROCEDURE -



MEASUREMENTS:

CVA Measurement for both Groups A & B:

A picture from the sagittal plane of each subject was taken to objectively access CVA through smart phone's camera with Surgimap application used for analysing photographs.

VAS Measurement for both Groups A & B:

For pain measurement of each subject, Visual Analogue Scale (VAS) was used individually. Each subject was asked to score their neck pain between 1-10.1-3 was minimal pain, 4-6was moderate and 9-10 score means more worsen pain. The verbal score of each subject was noted individually in data collective form.

ROM Measurement for both Groups A & B:

Cervical flexion & extension

Utilizing a goniometer originally positioned the focal point of the goniometer over the outside external auditory meatus. Adjust the fixed arm upward or opposite to the ground. Adjust the movable arm to the foundation of the nose. Note that as 0°. Then, at that point, subject was approached to flex and expand his/her neck and record readings of the goniometer at every limit of the movement. The hub ought to stay at the outside hear-able meatus and the fixed arm vertical to the floor; however the moving arm ought to be realigned following the foundation of the nose.

Cervical lateral flexion

Firstly, place the axis of the goniometer; over the spinous course of the C7 if inspecting from the back, or at the sternal score if looking at from the front. Adjust the patient's fixed arm along the fanciful line between the two acromion processes either upward or opposite to the floor or evenly and lined up with the floor. Adjust the subject's moving arm; over the outer occipital projection if analyzing from the back or along the focal point of the subject's nose if inspecting from the foremost. Consider this situation as 0°. Then, the subject was told to flex his/her neck horizontally and record readings of the goniometer at every limit of the movement. It was guaranteed that the pivot and the fixed arm stayed fixed all through the movement and change the moving arm as needs be.

Cervical rotation

To begin with, place the axis of the goniometer from above over to the focal point of the subject's head. Adjust his/her fixed arm along a nonexistent line between the two acromion processes. Adjust his/her moving arm at the tip of the nose. The subject was approached to turn his head. Readings of the goniometer were recorded at every limit of the movement. It was guaranteed that the pivot stays at the focal point of the patient's head, the fixed arm along the nonexistent line of the two acromion processes, and the moving arm realigned following the tip of the nose.

Randomization

Persons who met the inclusion criteria were randomly allocated to Groups A or B. The allotment was conducted by me prior to the baseline assessment and measurement. Group A underwent MET stretching whereas Group B received SNAG technique.

Interventions

Conventional therapy for both groups - A moist heat pack was applied to the neck region for 15 to 20 minutes prior to the intervention.[34]

Treatment Group A – Muscle Energy Technique

For Lower Cervical Vertebrae (C3-C7):

For example, at the C3-C4 level, the patient was positioned in a recumbent posture with the neck slightly flexed laterally by the practitioner. The practitioner placed their right middle finger on the right articular pillars of C3-C4. The neck was moved to the maximum point of side-bending and rotation toward the right, engaging the restriction. The left hand was positioned on the patient’s left parietal and temporal regions to provide counterforce. The

patient was instructed to perform side-bending and rotation toward the left against the practitioner's resistance for 5 seconds. Following a 5–7 second gentle contraction, post-isometric relaxation occurred, and the neck was moved to its new restrictive barrier. This technique was repeated 2–3 times.

For Upper Cervical Vertebrae (C1-C2):

The patient was placed in a supine position, and the practitioner passively flexed the head and neck to approximately 45º until resistance was felt. If the restriction was on the left, the practitioner rotated the head to the left until a restrictive barrier was reached. The patient was then instructed to gently push into the practitioner's hand (rotating to the right) for 5 seconds, followed by 5 seconds of relaxation. This cycle was repeated three times.

Treatment Group B–Mulligan SNAGS:

Rotation and Lateral Flexion:

- **Indications**: Painful and/or restricted rotation or lateral flexion.
- **Position**: Patient seated upright with the head in a neutral position.
- **Contact**: The medial border of the distal phalanx of one thumb is placed on the articular pillar, while the other thumb reinforces it to provide the mobilization force.
- **Glide**: Directed upward toward the eyeball, following the plane of the facet.
- **Movement**: The patient rotates or laterally flexes the head toward the painful side as the therapist maintains the glide.

Extension and Flexion:

- **Indications**: Painful and/or restricted extension or flexion.
- **Position**: Patient seated upright with the head in a neutral position.
- **Contact**: The medial border of the distal phalanx of one thumb is positioned on the spinous process, with the other thumb reinforcing it to deliver the mobilization force.
- **Glide**: Directed upward centrally toward the eyeballs, aligned with the plane of the facets.
- **Movement**: The patient performs extension or flexion while the therapist sustains the glide.

Fig 3.7 CVA measurement by Surgimap application

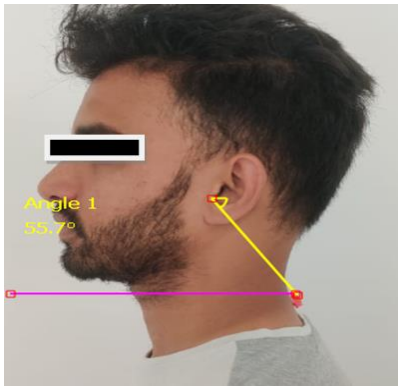


Fig 3.8 ROM measurement

DATA ANALYSIS

Thirty mobile phone users (both males and females) with mechanical neck pain participated in this study. Frequencies and percentages were calculated for qualitative data, while means (±SD) were computed for continuous data using SPSS software. A paired t-test was employed to compare pre-intervention and post-intervention scores for each variable within both groups separately. Analysis of variance (ANOVA) was performed at baseline and after the intervention to evaluate differences between groups. Statistical significance was defined as $P < 0.05$. A P-value > 0.05 was considered non-significant, whereas a P-value ≤ 0.05 indicated a significant difference. The confidence interval was set at 95%.

Demographic comparisons:

Table1: Depicts that the average mean age in years is 24.8(±SD3.68) in Group A and 22.6(±SD2.22) in Group B, the average mean height in feet is 5.5(±SD0.38) in Group A and 5.66(±0.41) in Group B and the mean weight in kg is 71.2(±SD12.9) in Group A and 64.86(±SD11.99) in Group B.

DEMOGRAPHIC DATA	GROUP A	GROUP B
	MEAN±SD	MEAN±SD
AGE	24.8±3.68	22.6±2.22
HEIGHT	5.5±0.38	5.66±0.41
WEIGHT	71.2±12.9	64.86±11.99

Table 1: Demographic comparisons between groups

Table 2: Gender between both groups showed that numbers of males and females subjects are same in both groups. There were 12 male and 3 female subjects participated in each group.

GENDER	MALE	FEMALE
GROUP A	12	3

GROUP B	12	3

Table 2: Comparison gender between groups

Within Group comparisons:

Table 3: Depicts that the average mean VAS (indicate the pain scale between 1-10) is 7.4(SD±0.63) in Pre intervention and 4.8(SD±0.86) in Post intervention within Group A, where 'p value' 0.00000024 is highly significant (p<0.001) and 't value' is 2.144.

VAS	PRE	POST	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD	2.144	0.00000024
	7.4±0.63	4.8±0.86		

Table 3: VAS within Group A

Table 4: Shows that the average mean VAS (indicate the pain scale between 1-10) is 6.93(SD±0.7) in Pre intervention and 4.26(SD±0.79) in Post intervention within Group A, where 'p value' 0.00000012 is highly significant (p<0.001) and 't value' is 2.144.

VAS	GROUP A	GROUP B	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD	2.048	0.08972
	7.4.±0.63	6.93±0.7		

Table 4: VAS within Group B

Table 5: Depicts that the average mean CVA in degree is 46.98 (SD±7.63) in Pre intervention and 47.64(SD±7.67) in Post intervention within Group A, where 'p value' 0.000164 is significant (p<0.001) and 't value' is 2.144.

CVA	PRE	POST	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD	2.144	0.000164
	46.98±7.63	47.642±7.67		

Table 5: CVA within Group A

Table 6: Depicts that the average mean CVA in degree is 48.28(SD±4.47) in Pre intervention and 49.48(SD±4.47) in Post intervention within Group B, where 'p value' 0.00000371 is significant (p<0.001) and 't value' is 2.144.

CVA	PRE	POST	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD	2.144	0.00000371
	48.28±4.47	49.48±4.47		

Table 6: CVA within Group B

Table 7: Depicts that the average mean and standard deviation ROM in degree is highly significant (p<0.001). It shows the improvements of all the range of motions (flexion,

extension, left flexion, right flexion, left rotation, right rotation) in post intervention in Group A.

ROM	PRE	POST	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD		
F	37.8±3.54	41.533±3.2	2.144	0.0000015
E	35.866±4.42	39.133±2.669	2.144	0.00031
LF	36.866±4.35	38.266±4.57	2.144	0.00065
RF	37.466±4.155	38.733±4.07	2.144	0.00421
LR	61.66±7.55	62.8±7.089	2.144	0.0059
RR	60.26±7.33	62.4±7.65	2.144	0.0000335

Table 7: Pre-Post ROM within Group A

Table 8: Depicts that the average mean and standard deviation ROM in degree is highly significant. It shows the improvements of all the range of motions (flexion, extension, left flexion, right flexion) except two range of motions (left rotation, right rotation) in post intervention in Group B.

ROM	PRE	POST	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD		
F	41.8±4.97	43.533±3.833	2.144	0.0034
E	39.533±3.85	41.133±3.77	2.144	0.0000084
LF	39.4±5.179	43.066+7.19	2.144	0.034
RF	40.533±5.26	42.733±7.12	2.144	0.04
LR	61.66±5.71	61.933±7.98	2.144	0.84
RR	60.03±6.97	60.933±7.75	2.144	0.334

Table 8: Pre-Post ROM within Group B

Comparisons between groups:

Table 9: Shows that there is no significant difference in Pre-VAS between two groups.

Table 9 Pre –VAS between both Groups

VAS	PRE	POST	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD	2.144	0.00000012
	6.933±0.7	4.266±0.79		

Table 10: Shows that there is no significant difference in Post-VAS between two groups.

VAS	GROUP A	GROUP B	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD	2.048	0.0664
	4.8±0.86	4.26±0.79		

Table: 10 Post-VAS between both groups

Table 11: Shows that there is no significant difference in Pre-CVA between two groups.

CVA	GROUP A	GROUP B	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD	2.048	0.57601
	46.98±7.63	48.28±4.477		

Table 11: Pre –CVA between both Groups

Table 12: Shows that there is no significant difference in Post-CVA between two groups.

CVA	GROUP A	GROUP B	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD	2.048	0.42964
	47.64±7.67	49.48±4.47		

Table 12: Post-CVA between both groups

Table 13: Depicts that the average mean and standard deviation ROM in degree is no significant differences in Pre-ROM between two groups except Flexion and extension.

PRE ROM	GROUP A	GROUP B	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD		
F	37.8±3.54	41.8±4.97	2.048	0.01711
E	35.866±4.42	39.533±3.85	2.048	0.02218
LF	36.866±4.35	39.4±5.179	2.048	0.15827
RF	37.466±4.155	40.533±5.26	2.048	0.0874
LR	61.66±7.55	61.66±5.71	2.048	1
RR	60.26±7.33	60.03±6.97	2.048	0.93953

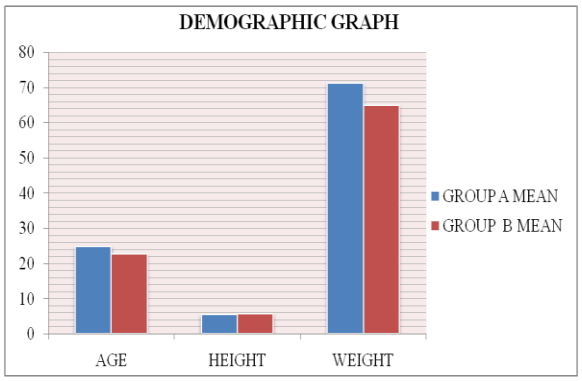
Table 13 Pre-ROM between both groups

Table14: Depicts that the average mean and standard deviation ROM in degree is no significant differences in Pre-ROM between two groups except lateral flexion.

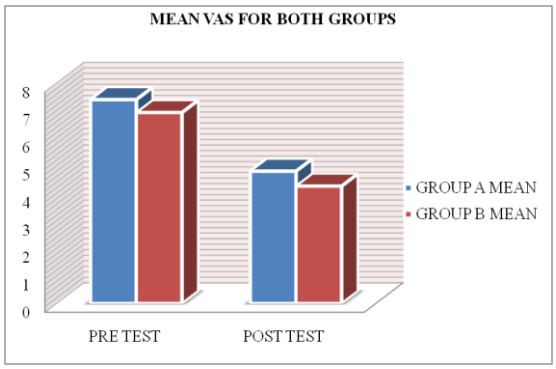
POST ROM	GROUP A	GROUP B	t-VALUE	p-VALUE
	MEAN±SD	MEAN±SD		
F	41.533±3.2	43.533±3.833	2.048	0.13228

E	39.133±2.669	41.133±3.77	2.048	0.10511
LF	38.266±4.57	43.066±7.19	2.048	0.0378
RF	38.733±4.07	42.733±7.12	2.048	0.0696
LR	62.8±7.089	61.933±7.98	2.048	0.75552
RR	62.4±7.65	60.933±7.75	2.048	0.60628

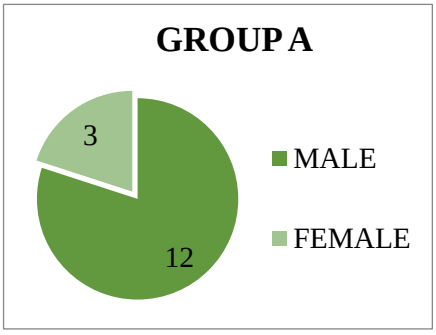
Table 14: Post-ROM between two groups

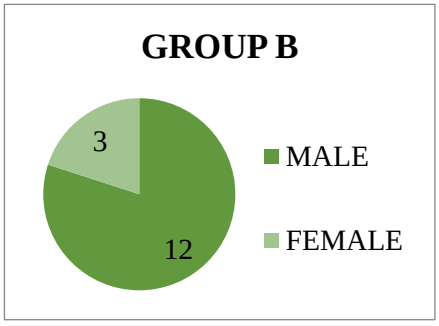


Graph 4.1 Demographic comparisons between groups

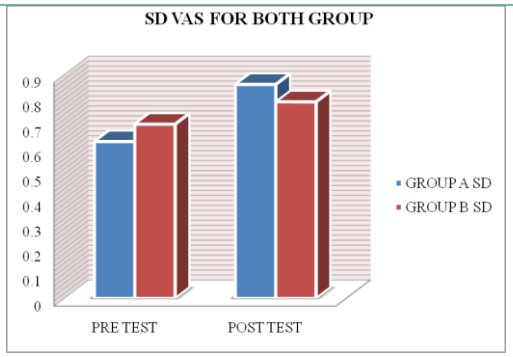


Graph 4.3: Pre-Post Mean VAS between both Groups

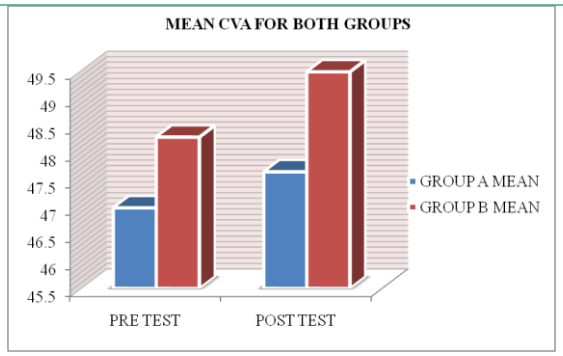




Graph 4.2 Gender between both groups

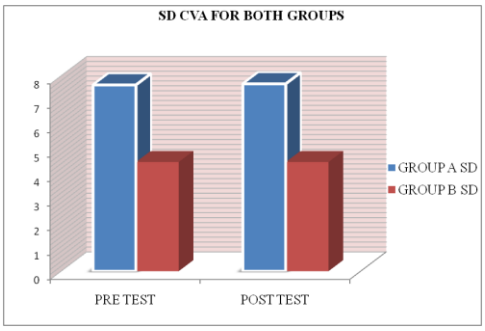


Graph 4.4 Pre-Post SD VAS between both Group

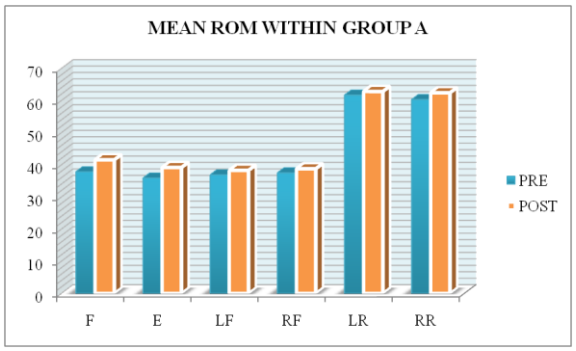


Graph 4.5: Pre-Post Mean CVA between both groups

Key to graph 4.3 & 4.4 - VAS: Visual Analogue Scale, 'Mean value': Average Value, 'SD value': Standard Deviation, 't value': Quantify the difference between the population, 'p value': The probability obtaining a t-value



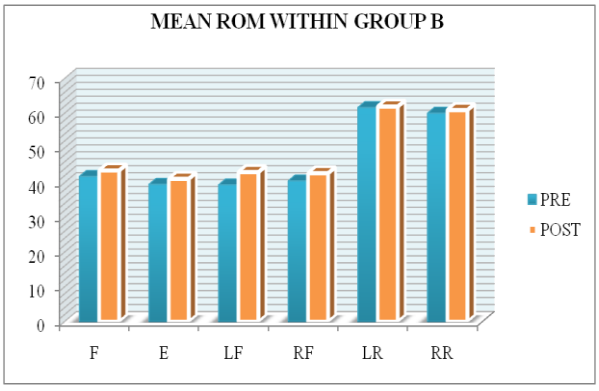
Graph 4.6; Pre-Post SD CVA between both groups



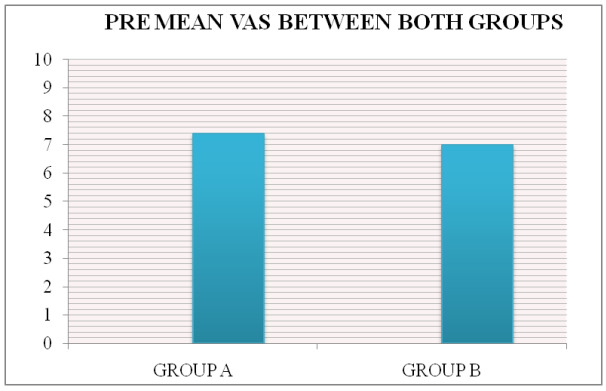
Graph 4.7: Pre-Post ROM within Group A

Key to graph 4.5 & 4.6: CVA: Cranio Vertibral Angle, 'Mean value': Average Value, 'SD value': Standard Deviation, 't value': Quantify the difference between the population, 'p value': The probability obtaining a t-value

Key to graph 4.7 - F: Flexion; E: Extension; LF: Left Flexion; RF: Right Flexion; LR: Left Rotation; RR: Right Rotation



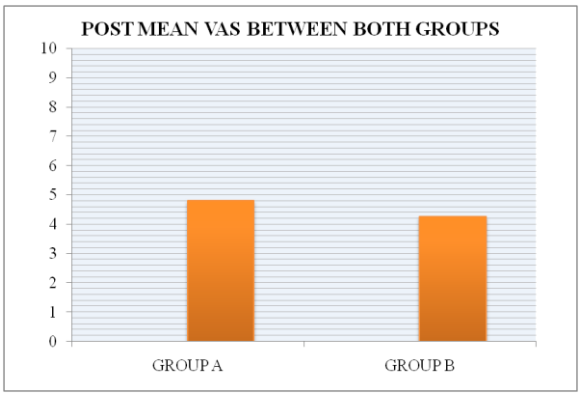
Graph 4.8: Pre-Post ROM within Group B



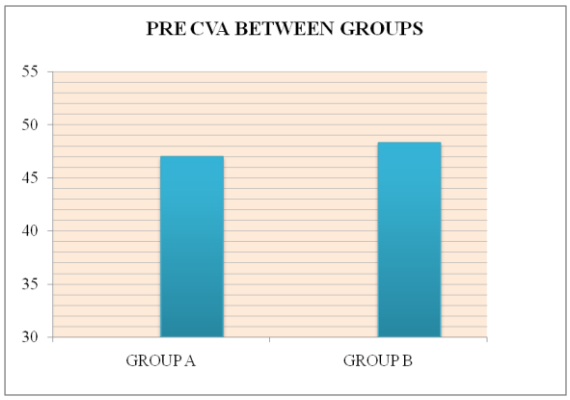
Graph 4.9 Pre-VAS between both groups

Key to graph 4.8 - F: Flexion; E: Extension;

LF: Left Flexion; RF: Right Flexion; LR: Left Rotation; RR: Right Rotation



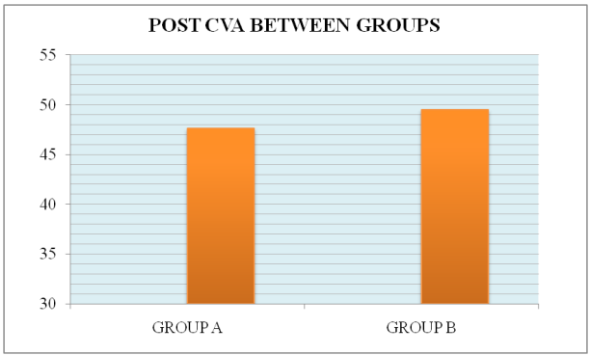
Graph 4.10: Post-VAS between both groups



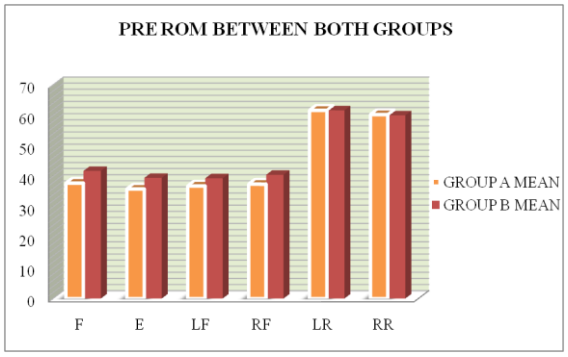
Graph 4.11:Pre-CVA between Both Groups

Key to graph 4.9 &4.10

VAS: Visual Analogue Scale; 'Mean value': Average Value; 'SD value': Standard Deviation 't value': Quantify the difference between the population; 'p value': The probability obtaining a t-value

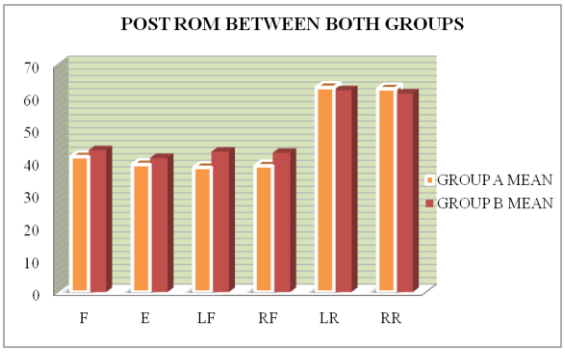


Graph 4.12: Post-CVA between both group



Graph 4.13 Pre-ROM between both groups

Key to graph 4.11 & 4.12 - CVA: Cranio Vertibral Angle; 'Mean value': Average Value; 'SD value': Standard Deviation; 't value': Quantify the difference between the population; 'p value': The probability obtaining a t-value



Graph 4.14: Depicts that the average mean and standard deviation ROM in degree is no significant differences in Pre-ROM between two groups except lateral flexion.

Graph 4.14: Post-ROM between two group

Key to graph 4.13& 4.14 - F: Flexion; E: Extension; LF: Left Flexion; RF: Right Flexion; LR: Left Rotation; RR: Right Rotation

DISCUSSION

The present study expected to evaluate the prompt impacts of back neck MET extending alongside supported regular apophyseal coast on pain CVA and neck ROM in subjects with weighty cell phone clients. Inside bunch examination uncovered that there was a critical lessening in persistent revealed pain scores and huge expansions in CVA when pre and post-mediation scores were looked at in the two gatherings.

The current investigation discovered That inside the gathering for MET, there was a huge improvement in CVA, VAS, and Cervical ROM. Be that as it may, for the SNAG group, there was likewise a huge improvement in CVA, and VAS yet no critical improvement in the left and right pivot at cervical ROM.

Between gatherings, no measurably massive distinction in CVA and VAS among MET and SNAG Groups. Be that as it may, there are genuinely tremendous contrasts in flexion and augmentation at standard cervical ROM between the two gatherings, which was not there post-treatment, recommending there has been an improvement. Likewise left (significant) and right flexion expanded for group B.

Interpretation of improvement in Muscle Energy Technique (MET):

The reduction in pain intensity observed in the MET group can be attributed to the hypoalgesic effects of MET. This is explained by the activation of the Golgi tendon reflex during isometric contraction, which leads to reflex muscle relaxation. The activation of muscle and joint mechanoreceptors triggers sympathoexcitation through somatic efferents and localized activation of the periaqueductal gray matter, playing a role in descending pain modulation. MNP (myofascial neck pain) often originates from lesions in the zygapophyseal (facet) joints or muscle spasms in the cervical region. MET is effective in increasing the range of motion due to mechanisms such as post-isometric relaxation (PIR) and reciprocal inhibition (RI).

Interpretation of improvement in Sustained Natural Apophyseal Glides (SNAG):

The physiological effects of Mulligan's SNAG (Sustained Natural Apophyseal Glide) technique include stretching the structures on the convex side of the restricted movement and widening the intervertebral foramen on the same side, which helps to release the stuck facet joint. It may also correct the positional misalignment between the affected facets by facilitating the cranial glide of the inferior facet of the superior vertebra over the superior facet of the inferior vertebra, thereby improving joint biomechanics. Additionally, this technique can potentially release entrapped meniscoid tissue within the facet joints. The neurophysiological effects involve stimulating mechanoreceptors and proprioceptors in and around the joints, which helps relax the surrounding muscles. The mobilization-induced movement also contributes to nourishing the facet joints and intervertebral discs.

Cervical Vertebral Angle (CVA) significantly influences pain in individuals with Forward Head Posture (FHP). A reduced CVA leads to forward flexion of the cervical vertebrae, which, if maintained for prolonged periods, increases the load on the extensor muscles (by lengthening the external moment arm) and surrounding connective tissues.

The Visual Analogue Scale (VAS) is widely used both nationally and internationally. In this study, it was empirically evident that the VAS is a reliable and valid tool for individuals aged 18 and above. While numerous studies have confirmed the reliability of the VAS, its validity has shown moderate to strong correlations for pain measurement. Historically, the VAS has been the preferred scale, but there is now a shift toward adopting other robust and validated tools, such as the Numeric Rating Scale (NRS).

Further research is required to better define CVA changes in both sitting and standing positions and to establish a consistent protocol for the long-term use of both Muscle Energy Techniques (MET) and Sustained Natural Apophyseal Glide (SNAG) methods.

LIMITATION OF STUDY

1. The sample size was small.
2. The duration of study was limited.
3. The study is limited on subjects aged 18 to 30 years.

FUTURE RECOMMENDATION

1. Sample size can be larger.
2. To see the inter-rater reliability of this study.
3. We can find the difference between male & female population.
4. We can measure other postural angles & then compare the results.
5. We can compare the measurement of CVA with asymptomatic neck pain.
6. We can also compare with different age group population.

CONCLUSION

This trial study was performed on 30 Smartphone clients and 15 patients in each gathering with protests of neck agony and versatility shortage. From the examination of the current review, it tends to be reasoned that the SNAG Mulligan technique and MET

extending are successful in diminishing agony, expanding CVA, and working on cervical ROM in patients with mechanical neck torment, as there was no tremendous distinction between the two gatherings.

REFERENCES

1. Arslan, A. and A.T. ¨¹nal, Examination of cell phone usage habits and purposes of education faculty students. International Journal of Human Sciences, 2013.
2. Kaukab Imam, Shamim A Ansari, Mobile phone addiction in relation to anxiety. International Journal of Advanced Research and Development, 2018, Volume 3; Issue 3; Page No. 85-87.
3. Effect of heavy and light smartphone use on whole spine curvature profile and cervical mobility in young adults P. Salviaa,∗, R. Cohenb, O. D'Halluinc, S. Van Sint Janc, V. Feipeld, B. Beyere Gait & Posture 65 (2018) 144–145.
4. The Effect of Posture and Duration of Smartphone Usage on Neck Flex-ion Angle

Sundus Alfaitouri and Ahamed Altaboli1 Industrial and Manufacturing Systems Engineering Department, University of Benghazi, Benghazi, Libya, Proceedings of the Human Factors and Ergonomics Society 2019 Annual Meeting.

5. Burgess-Limerick, R., A. Plooy, and D. Ankrum, The effect of imposed and self-selected computer monitor height on posture and gaze angle. Clinical Biomechanics, 1998. 13(8): p. 584-592.
6. Osama M, Ali S, Malik R. Posture related musculoskeletal discomfort and its association with computer use among university students. J Pak Med Assoc. 2018; 68:639-41.
7. Osama M. Musculoskeletal Discomfort among Undergraduate Students. Inter J Rehab Sci. (IJRS). 2017;6.
8. Fejer R, Kyvik KO, Hartvigsen J. The prevalence of neck pain in the world population: a systematic critical review of the literature. Eur Spine J. 2006; 15:834-48.
9. Hogg-Johnson S, Van Der Velde G, Carroll LJ, Holm LW, Cassidy JD, Guzman J, et al. The burden and determinants of neck pain in the general population. Eur Spine J. 2008;17:39-51.
10. Yip CHT, Chiu TTW, Poon ATK. The relationship between head posture and severity and disability of patients with neck pain. Man Ther. 2008;13: 148-54.
11. Silva AG, Punt TD, Sharples P, Vilas-Boas JP, Johnson MI. Head posture and neck pain of chronic nontraumatic origin: acomparison between patients and pain-free persons. Arch PhysMed Rehabil. 2009;90:669-74.
12. Effect of muscle energy techniques and facet joint mobilization on spinal curvature in patients with mechanical neck pain: A pilot study Muhammad Osama,1 Naureen Tassadaq,2 Reem Javed Malik3 Vol. 70, No. 2, February 2020.
13. Text Neck Syndrome - Systematic Review**,** Sunil Neupane1, U T Ifthikar Ali2, Mathew A3 M V Shetty College of Physiotherapy, Mangalore.Imperial Journal of Interdisciplinary Research (IJIR) Vol-3, Issue-7, 2017,ISSN: 2454-1362,

14. Neupane, S., Ali, U. I., Mathew, A. Text neck syndrome-Systematic review. Imperial J Interdisciplinary Res. 2017; 3(7): 141-148.
15. Vate, Lan P., Text neck epidemic: a growing problem for smart phone users in Thailand. Int J Comput Internet Manag. 2015; 23(3): 1-55.
16. Sudaryanto, Sutjana DP, Irfan M. Pemberian teknik mulligan dan soft tissue mobilization lebih baik daripada hanya soft tissue mobilization dalam meningkatkan lingkup gerak sendi ekstensi, rotasi, lateral fleksi cervical pada mechanical neck pain. *Sport Fitn J*. 2013:1(2):54-69.
17. The efficacy of muscle energy technique in individuals with mechanical neck pain: a systematic review. Nugraha, Made Hendra Satria.1 Antari, Ni Komang Ayu Juni.2 Saraswati, Ni Luh Putu Gita Karunia3 Sport and Fitness Journal E-ISSN: 2654-9182 Volume 8, No.2, Mei 2020: 91-98
18. Gharbawi, B. Text Neck Syndrome: A new concern for physical therapists worldwide. EC Orthopaedics. 2017; 8(3): 89-91.
19. Singla, D., Vegar, Z. Association between forward head, rounded shoulders and increased thoracic kyphosis: A reviewed of the literature. Pubmed. 2017; 16(3): 220-229.
20. Kim, H. J., Kim, J. S. The relationship between smartphone use and subjective musculoskeletal symptoms and university students. J Physical Therapy Sci. 2015; 27(3): 575-579.
21. Lee, J. I., Song, H. S. The correlation analysis between hours of smartphone use and neck pain in the Gachon university students. The Acupuncture. 2014; 31(2): 99-109 .
22. Hartrick CT, Kovan JP, Shapiro S. The numeric rating scale for clinical pain measurement: a ratio measure? Pain Practice. 2003 Dec;3(4):310-6.
23. Journal of Medical Case Reports and Reviews Received 30 Aug 2019 | Revised 01 Sep 2019 | Accepted 2 Sep 2019 | Published Online 6 Sep 2019 JMCRR 02 (11), 394-402 (2018) ISSN (O) 2589-8655 | (P) 2589-8647
24. Gupta N, Gupta S, Agarwal A, Agarwal S, Mahto R. A comparison of visual analogue scale and Wong Baker facial pain scale for pain measurement in post lower caesarean section case. International Journal of Reproduction, Contraception, Obstetrics and Gynecology.;5(9):3033.
25. Rosier EM, Iadarola MJ, Coghill RC. Reproducibility of pain measurement and pain perception. Pain. 2002 Jul 1;98(1-2):205-16.
26. Nagrale, AV., Glynn, P., and Joshi, A. The Efficacy of an Integrated Neuromuscular Inhibition Technique on Upper Trapezius Trigger Points in Subjects with Non-specific Neck Pain: A Randomized Controlled Trial, Journal of Manual and Manipulative Therapy 2010: 18(1).
27. Oliveira-Campelo, NM., de Melo, CA., Alburquerque-Sendıı´n, F., Machado, JP. Short- and Medium-Term Effects of Manual Therapy on Cervical Active Range of Motion and Pressure Pain Sensitivity in Latent Myofascial Pain of the Upper Trapezius Muscle: A Randomized Controlled Trial. Journal of Manipulative and Physiological Therapeutics. 2013:36.

28. Phadke, A. Bedekar, N. Shyam, A., and Sancheti, P. Effect of Muscle Energy Technique and Static Stretching on Pain and Functional Disability in Patients with Mechanical Neck Pain: A Randomized Controlled Trial. Hong Kong Physiotherapy Journal. 2016:35:5-11.
29. Sadria, G., Hosseini, M., Rezasoltani, A., Bagheban, AA., Davari, AR., and Seifolahi,
Comparison of the Effect of the Active Release and Muscle Energy Techniques on the Latent Trigger Points of the upper Trapezius. Journal of Bodywork & Movement Therapies. 2017:21(4):920-25.
30. Kashyap, R., Iqbal, A., and Alghadir, AH. 2018. Controlled Intervention to Compare the Efficacies of Manual Pressure Release and the Muscle Energy Technique for Treating Mechanical Neck Pain due to Upper Trapezius Trigger Points. Journal of Pain Research 2018:11:3151–60.
31. Kumar D. Manual mulligan concept: International Edition (Paperback),Capri Institute of Manual Therapy. 2nd ed, New Delhi: India; 2015. p.19-20
32. Efficacy of Sustained Natural Apophyseal Glides Mulligan Technique on Mobility and Function in Patients with Cervical Spondylosis: An Experimental Study S. Arul Pragassame, V. K. Mohandas Kurup, Jasmine Kour Department of PM and R, RMMC and H, Annamalai University, Chidambaram, Tamil Nadu, India. Accepted: 23-Mar-2020 Revised: 08-Feb-2020 Published: 22-Jul-2020
33. Chaitow L. Muscle energy techniques 2nd ed. 2006 Edinburgh: Churchill Livingstone;1-187.
34. ChhabraS,Chabra D, SachdevaJ, ChaudharyA.The effectiveness of self SNAGS over conventional physiotherapy management in chronic neck pain among computer professionals. Indian Journal of Physiotherapy and Occupational Therapy2008;2(3)
35. Fryer,G .and Ruszkowski,W. The influence of contraction duration in muscle energy technique applied to the atlanto axial joint. J. Osteopathic Med., 2004;7(2):79-84.
36. To study the effect of muscle energy technique versus Mulligan snags on pain, range of motion and functional Disability for individuals with mechanical neck Pain: a comparative study Krupa d. Tank, prachi choksi , priyanka makwana, Int J Physiother Res 2018, Vol 6(1):2582-87
37. Parmar S, Shyam A, Sabnis S, Sancheti P. The effect of isolytic contraction and passive manual stretching on pain and knee range of motion after hip surgery: A prospective, double-blinded, randomized study. Hong Kong Physiotherapy Journal 2011; 29:25-30.
38. Chaitow L, Crenshaw K. Fritz S, Fryer G, Liebenson C, Muscle energy techniques. .
Wolfaard S, editor. Elsevier Health Sciences; 2006
39. Nagrale, AV., Glynn, P., and Joshi, A. The Efficacy of an Integrated Neuromuscular Inhibition Technique on Upper Trapezius Trigger Points in Subjects with Non-specific Neck Pain: A Randomized Controlled Trial, Journal of Manual and Manipulative Therapy 2010: 18(1).
40. Phadke, A. Bedekar, N. Shyam, A., and Sancheti, P. Effect of Muscle Energy Technique and Static Stretching on Pain and Functional Disability in Patients with Mechanical Neck Pain: A Randomized Controlled Trial. Hong Kong Physiotherapy Journal. 2016:35:5-11.

41. Randomized Controlled Trial. Journal of Manipulative and Physiological Therapeutics. 2013:36(5).
42. Sadria, G., Hosseini, M., Rezasoltani, A., Bagheban, AA., Davari, AR., and Seifolahi, A. A Comparison of the Effect of the Active Release and Muscle Energy Techniques on the Latent Trigger Points of the upper Trapezius. *Journal of Bodywork & MovementTherapies*. 2017:21(4):920-25.
43. Kashyap, R., Iqbal, A., and Alghadir, AH. 2018. Controlled Intervention to Compare the Efficacies of Manual Pressure Release and the Muscle Energy Technique for Treating Mechanical Neck Pain due to Upper Trapezius Trigger Points. Journal of Pain Research 2018:11:3151–60.
44. Kumar D. Manual mulligan concept: International Edition (Paperback), Capri Institute of Manual Therapy. 2nd ed, New Delhi: India; 2015. p.
19-20.
45. Susan A Reid,Darren A.Rivett,Michael G.Katekar,Robin Callister : Sustained natural apophyseal glides (SNAG'S) are an effective treatment for cervical pain or cervical dizziness. Journal of manual therapy published on 22 October 2007.
46. Hurwitz EL, Aker PD, Adams AH, Meeker WC and Shekelle PG. Manipulation and mobilization of the cervical spine: a systematic review of the literature. Spine. 1996; 21:1746-59.
47. Mulligan, B. R,, "SNAGS", In, Published Papers IFOMT Congress 1988.
48. Miller J. The mulligan concept: the next step in the evolution of manual therapy. Published Orthopaedic Division Review May/June1999.
49. Edmondston SJ, Sharp M, Symes A, Alhabib N, Allison GT. Changes in mechanical load and extensor muscle activity in the cervico-thoracic spine induced by sitting posture modification.Ergonomics2011;54(2):179-86.
50. Yip CH, Chiu TT, Poon AT. The relationship between head posture and severity and disability of patients with neck pain. Man Ther 2008;13(2)
51. Validity and reliability of visual analogue scale (vas) for pain measurement Mst. Rabea Begum, Mohammad Anwar Hossain2,Centre For the Rehabilitation of The Paralysed (CRP), Savar, Dhaka, Bangladesh Published Online 6 Sep 2019 JMCRR 02 (11), 394-402 (2018) ISSN (O) 2589-8655 | (P) 2589-8647