European Review for Medical and Pharmacological Sciences | 2023; 27: 8340-8349

Effectiveness of neck stabilization and Contrology training in comparison to conventional therapy amongst individuals with Text Neck Syndrome

S. BHARAL[1], M.R. RIZVI[1], M.M. ALQAHTANI[2], R.A. ALAJAM[3], A. SHARMA[1], I. AHMAD[1], M.L. AL-OTAIBI[4], M.M. ALSHEHRI[3], M.M. AHMAD[5], M.A. SHAPHE[3], I. AHMAD[5], F. AHMAD[2], M. MIRAJ[6], M. ALZHRANI[6], A.D. ALANAZI[6], G.M. SHAWKY[6]

[1]Department of Physiotherapy, Faculty of Allied Health Sciences, Manav Rachna International Institute and Studies (MRIIRS), Faridabad, India
[2]Respiratory Care Department, College of Applied Sciences, Almaarefa University, Diriya, Riyadh, Saudi Arabia
[3]Physical Therapy Department, College of Applied Medical Sciences, Jazan University, Saudi Arabia
[4]Department of Orthopedic Surgery, King Khalid University, Abha, Saudi Arabia
[5]Department of Medical Rehabilitation Sciences, College of Applied Medical Sciences, King Khalid University, Saudi Arabia
[6]Department of Physical Therapy and Health Rehabilitation, College of Applied Medical Sciences, Majmaah University, Al Majmaah, Saudia Arabia

Abstract. – OBJECTIVE: Cell phones are carried by 79% of people between 18 and 44 years of age for nearly the entire day. Smartphone users spend an average of three hours/per day on their devices, whereas heavy smartphone users spend 8-10 hours/per day on their devices. Text neck is a dangerous disorder that can accelerate the degeneration of the spine. This study aimed to investigate the efficacy of neck stabilization training *vs.* Contrology or Pilates training in individuals with Text Neck Syndrome.

PATIENTS AND METHODS: Participants (n=75) with a history of recurrent neck pain in the previous four months, having moderate pain (at least 4/10 on the numeric pain rating scale, NPRS), and constantly using mobile phones (>4 hours/day) were randomly allocated to one of three groups: a control group (neck isometric training) and two intervention groups (neck stabilization training and Contrology). They were assessed for craniovertebral angle (CVA), NPRS, and neck disability index (NDI) at baseline and at 4 weeks post-intervention.

RESULTS: There was a significant difference in the CVA, NPRS, and NDI among individuals with Text Neck Syndrome following intervention as compared to the control. Both the neck stabilization and Contrology training increased CVA and reduced neck pain and neck disability in individuals with Text Neck Syndrome. The two intervention groups showed similar effects in all the clinical outcome measures, suggesting almost equivalent effectiveness in the individuals with Text Neck Syndrome.

CONCLUSIONS: Neck stabilization seems to work better than Contrology training when it comes to increasing the craniovertebral angle, reducing pain intensity, and making it easier for individuals with Text Neck Syndrome to move their necks.

Key Words:
Craniovertebral angle, Neck disability index, Contrology or Pilates, Text Neck Syndrome, Muscle Strength, Lifestyle measures, Behavior modification.

Introduction

More and more individuals are using handheld gadgets like smartphones, tablets, and e-readers because. Nowadays, mobile technology has deeply grown[1]. The “text neck” is the result of prolonged neck flexion while hunched over modern electronic devices, especially smartphones. It is an emerging health hazard impacting many people of all ages, which could potentially harm millions of people[2]. When we look down at our mobile device for a lengthy amount of time, we can get overuse syndrome or a repetitive stress injury[3]. According to some studies, 79% of people between the ages of 18 and 44 have their cell phones with them for the vast majority of the day[4]. According to a recent Times of India’s poll, 82 million Indian adults use smartphones. The average day for casual smartphone users is 3 hours, while daily usage for avid smartphone users is 8 to 10 hours. Text neck is a dangerous

Corresponding Author: Fuzail Ahmad, MD; e-mail: fahmad@mcst.edu.sa

ailment that can cause early spinal degeneration and spine wear and tear[5].

Neck pain, stiffness, and soreness are the most typical symptoms of text neck. Radiating discomfort, upper back pain, shoulder pain, headache, sleeplessness, tingling, numbness in the hands, and muscular weakness of the shoulder muscles are some of the additional symptoms[5]. Along with these typical symptoms, there may also be lung capacity reduction, flattening of the thoracic kyphosis, early-onset arthritis, spinal degeneration, and disc compression[5].

The weight of the typical head produces about 10-12 lbs of strain through the neck muscles when the body is erect and the ears are in line with the middle of the shoulders. However, the weight of the head substantially increases to around six times its original weight when we move it forward by one inch from the neutral position. For instance, at 15° of forward tilt, there is 27 lbs increase in force on the neck; at 30° up to 40 lbs increase; at 45° to 49 lbs increase; at 60° to 60 lbs increase; and at 90° the model's prediction is unreliable. When using a smartphone, individuals frequently look downward at lowered objects and keep their heads cocked forward for extended periods of time, which can lead to neck strain[6].

A "text neck" can result in swelling of the neck ligaments, muscles, and nerves, as well as chronic arthritic damage and an increase in the cervical spine's curvature, if it is not treated. The most beneficial position for the spine is an ideal posture, which reduces spinal tension. People frequently have a habit of bending their necks to look at the screen of their mobile phones when using them. This heightens the forward head posture (FHP) and maintaining this stance results in the loss of the cervical spine's natural "C" curve. Instead, the cervical vertebrae start to curve forward, which changes the spine's typical biomechanics and affects posture[7].

FHP is a head-on-trunk misalignment. It is described as an excessively forward head position while sitting or standing, in relation to a vertical line, an increased lower cervical spine lordosis (head forward, middle cervical spine extended, reduced cervical spine flexed), and rounded shoulders with a result in thoracic kyphosis[4]. However, it is believed that FHP is caused by habitual postures (such as working postures) that are held for extended periods, making them the ones that need to be fixed through exercises. Everyone agrees that long-term FHP can instigate this muscle imbalance, which may in turn lead to its persistence[6]. Previous studies[6,8] found that having your head tilted forward was linked to having a smaller craniovertebral angle (CVA). A CVA of less than 48-50 indicates greater FHP. It has been linked to neck discomfort and dysfunction[9].

Exercises called stabilization exercises are designed to maximize function and stop injury progression or re-injury. They need the shoulder girdle, anterior and posterior cervical muscles to be well coordinated and trained[10]. By reconditioning and increasing general muscle control to accomplish any loss of muscle activity produced by the injury or muscle wasting, stabilization exercise is an intervention meant to protect and prevent the spinal segments from re-injuries.

Exercises for neck stability serve to repair muscle irregularities and restore the muscles' proper function in supporting and stabilizing the spine. Exercises for neck stabilization clearly help to lessen discomfort and incapacity. Contrariwise, Pilates or Contrology training concentrates on improving our physical and mental health. This workout is designed to strengthen the muscles that support the trunk. Pilates offers widespread spinal mobility as well as both static and dynamic postural adjustments. Patients with non-specific chronic neck pain have been shown to benefit from Pilates exercises in terms of reduced pain and impairment[11,12]. The goal of conventional isometric training (CIT) is to enhance the neck muscles' isometric function, which works against gravity to keep the head and neck in an upright position. Peak isometric neck strength values were found to be statistically lower in persons with chronic neck pain than in healthy controls in all the movements[13].

Not enough research has been done for evaluating the effectiveness of neck stabilization and Contrology in treating Text Neck Syndrome, making it difficult to determine whether the therapeutic approach is more successful. In order to assess the effects of neck stabilization Contrology training on the craniovertebral angle, discomfort, and neck impairment in patients with Text Neck Syndrome, the study compares the two types of exercises[11].

Patients and Methods

The study comprised 75 patients between the ages of 18 and 40 with a recurrent history of neck pain in the previous 4 months, a pain level greater than or equal to 4/10 on the NPRS (moderate pain), and those who used mobile phones for more than 4 hours per day. Subjects with a history of pathological (traumatic, congenital, and surgical) problems around the spine and upper limbs, with head injury or a migraine, or any other neurological or orthopedic conditions, and those who used spectacles were excluded. The subjects were instructed on the study's goal before providing informed consent. The Ethics Research Committee, Manav Rachna International Institute of Research and Studies provided ethical approval (MRIIRS/FAHS/DEC/2021-M16 dated 9th April, 2021).

The study design was a multi-armed, randomized controlled trial with 3 groups, two intervention groups, and one control group. The subjects who met inclusion criteria were randomly assigned to three different groups: one control group (neck isometric exercise) and two intervention groups (neck stabilization and Contrology training group). Participants in all three groups were assessed with craniovertebral angle, pain, and neck disability index at baseline and 4 weeks after intervention respectively. A number of demographic data were collected from the participants before the start of the trial, including age, weight, height, and the length of time they had been experiencing neck pain. The detail of the study design is presented in Figure 1.

The intervention was conducted 3 sessions per week for 4 weeks. Intervention regimens for neck stabilization and Contrology training are described in the Exercise protocol[10,14,15]. Each exercise was given to the subjects individually supervised by the physiotherapist. The researcher ensured the proper technique of each exercise. All the exercises were given in the OPD, Department of Physiotherapy, MRIIRS.

For assessing the Text Neck Syndrome, a self-reported questionnaire was provided to all the subjects. Some of the key issues addressed in the questionnaire were the average time duration for which mobile has been used, any problem related to vision or body posture faced by the user,

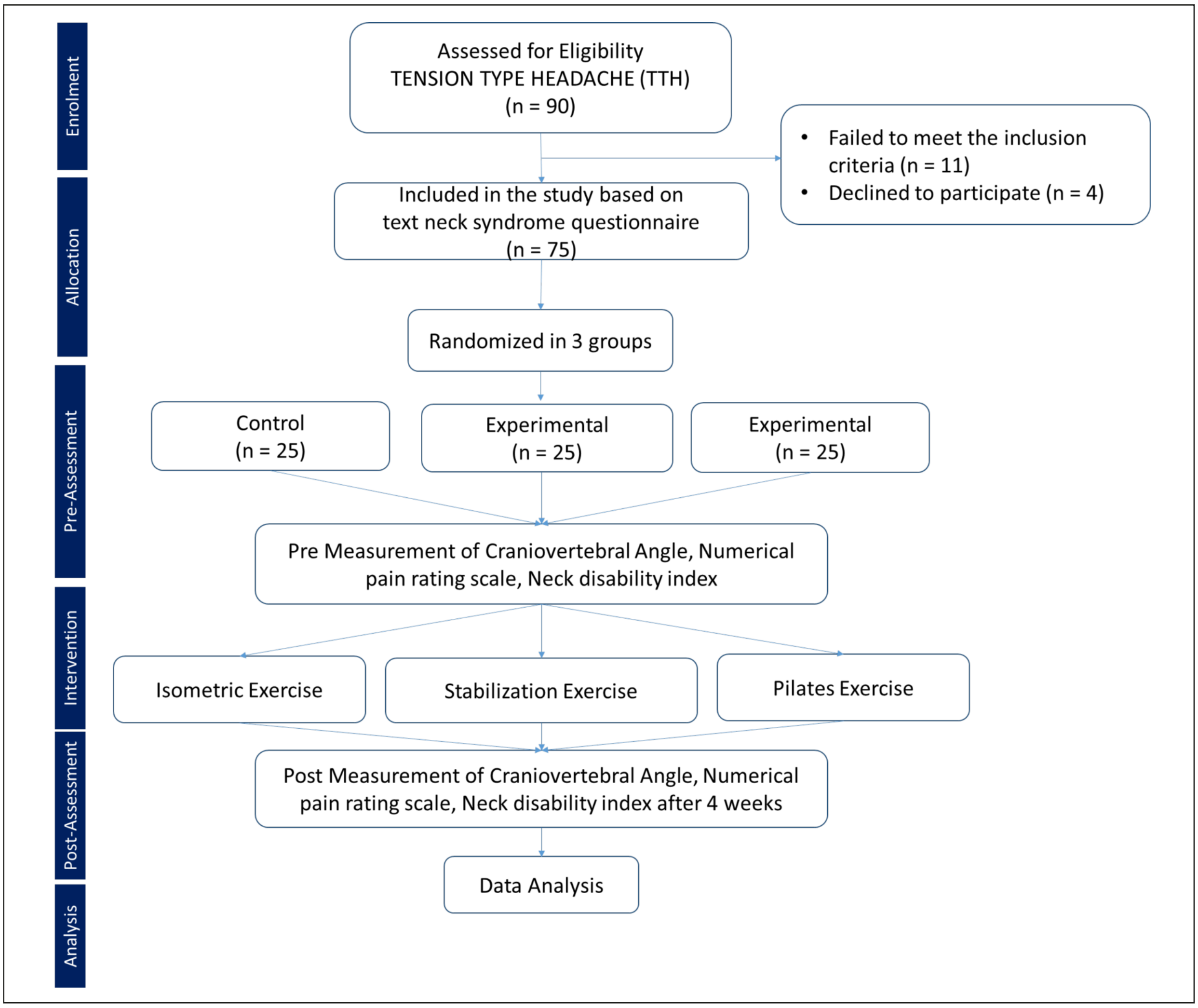

Figure 1. Consort chart of the study.

and self-perception of position while using mobile phones along with photo analysis (Figure 2). The participant's own self-perception of their neck posture while using a mobile phone was evaluated with the help of a question that illustrated a person texting on a mobile phone adopting four different neck postures. The participant was given four response options, including "1" or "2" for "no text neck" and "3" or "4" for "text neck". The subjects were asked to choose the most appropriate option, which they think suits them the most.

The subjects were instructed verbally to stand properly, relax, and input the text "the thing you enjoy to do the most" on their mobile phone, before and after the 4-week intervention. Lateral images were then taken before and after the intervention. Digital images were captured using a camera mounted on a tripod that was 2.5 meters away from the participant and 0.8 meters in height. Two raters with 10 years of clinical expertise in musculoskeletal physiotherapy and one rater with 17 years of clinical experience received the images after they had been imported into a computer. The four postures used for the self-report were illustrated for the raters, who were then asked to categorize each posture as "normal" (=1), "acceptable" (=2), "inappropriate" (=3), and "excessively improper" (=4) depending on the degree of head protrusion or flexion in the image. Each physiotherapist's response was given a single dichotomized variable ['1' or '2' (no text neck) against '3' or '4 (text neck)]. The physiotherapist's assessment of the text neck was made in accordance with the absolute agreement of at least two

Figure 2. Lateral photograph for photographic analysis for Text Neck Syndrome.

of the three raters; text neck was the combination of the result of the three dichotomized variables.

The craniovertebral angle was measured to see if the person had an FHP. Markers were put on the right tragus and the spinous process of C7 with double-sided tape. These are used to show where the head and neck are in the sagittal plane. The subjects were told to stand calmly with their arms at their sides. They were told to focus on a point on the wall directly in front of them in the way that felt most natural to them (without attempting to stand unusually straight). The camera was set up on a tripod 80 cm away from the subject's right side. The picture was then taken and uploaded to MB-ruler, a computer program (version 5.3, Markus Bader - MB-Softwaresolutions, Antwerp, Belgium Europe). The craniovertebral angle was identified by finding the angle between a line

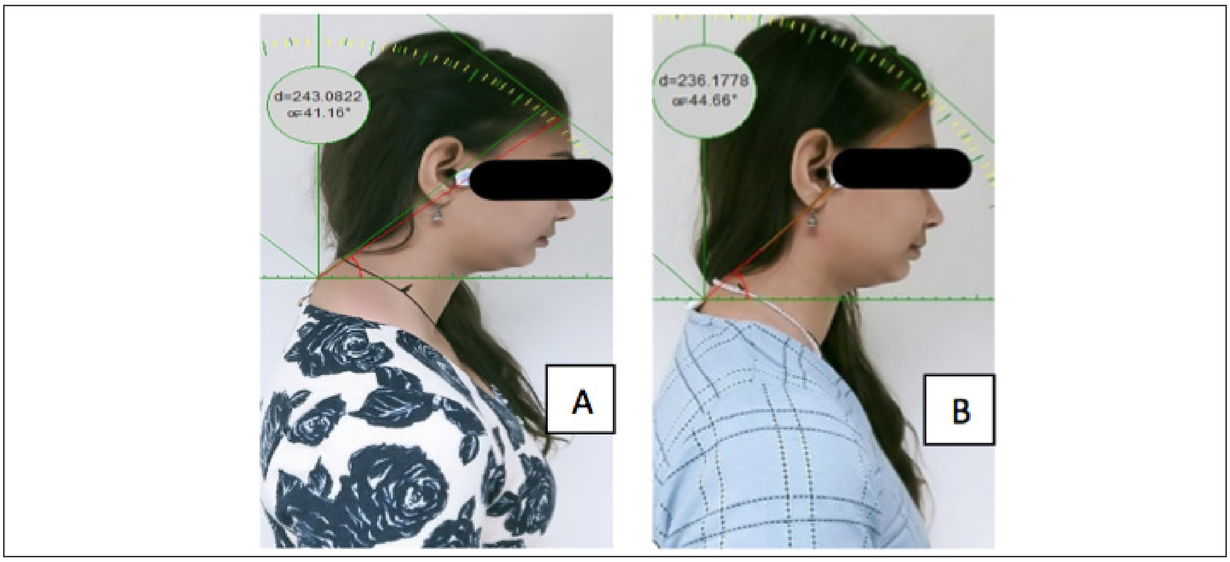

Figure 3. Assessment of craniovertebral angle. **A**, Pre-values (before intervention). **B**, Post-values (after 4 weeks of intervention).

going horizontally from C7 and a line going from the tragus of the ear to C7 (Figure 3).

Neck disability index (NDI) was used to assess self-rating disability patients with neck pain. NDI was given to the subjects to respond, and the subjects were asked to choose the most appropriate option from all the 10 items that define their current situation. Each response was scored on a six-point scale, with a score of 0 representing no disability and a score of 5 representing total disability. A total score between 0 and 50 is determined by adding the numerical responses to each item. The raw score was used for analysis. Higher scores represent increased levels of self-rated disability.

The severity of pain was assessed using the numeric pain rating scale (NPRS). It is described on an 11-point scale, with 0 representing no pain and 10 the most acute or unbearable kind of agony. With an ICC value ranging from 0.67 to 0.96, the test-retest reliability for the NPRS has been shown to be moderate to excellent[16].

Statistical Analysis

Statistical analysis was done with the help of SPSS v.23 (IBM Corp., Armonk, NY, USA). Demographic data were presented as mean and standard deviation (SD). The data were checked for normality following the Shapiro-Wilk test. All data was found to be normally distributed. One-way analysis of Variance (ANOVA) was utilized to compare the baseline values between the three groups. Repeated measures 3×2 ANOVA were used to determine the difference between and within the three groups. If baseline values show a significant difference between the groups, then repeated measure 3×2 analysis of covariance (ANCOVA) was applied to take pre-values as covariates. When a significant F-value was achieved, Bonferroni post-hoc analysis was performed to compare the differences between the three groups (neck stabilization, Contrology, and neck isometric training group) figuring out where the statistically significant differences were, and which of the three treatments was more successful. In addition, paired *t*-test was used to find out the changes within the group (before and after intervention) for all three groups. All statistical tests were conducted at a significance level of *p*-value<0.05 and a confidence interval set at 95%.

Results

There was no significant difference found in age and BMI at baseline values when comparing between the three groups. Craniovertebral angle showed no significant difference between the three groups at baseline. However, a statistically signi-

Table I. One way ANOVA to compare demographic characteristics and baseline values of craniovertebral angle, NPRS and NDI between the three groups among patients with Text Neck Syndrome.

Outcome Variables	Groups	Mean ± SD	95% of confidence interval: Lower Bound	95% of confidence interval: Upper Bound	F-value	*p*-value
Age	Isometric Exercise (Control)	28.46 ± 5.61	25.07	31.85		
	Neck Stabilization training	26.69 ± 5.53	23.35	30.03	1.186	0.3171
	Contrology training	25.25 ± 4.39	22.46	28.04		
BMI	Isometric Exercise (Control)	22.38 ± 2.14	21.09	23.68		
	Neck Stabilization training	23.41 ± 2.60	21.84	24.98	0.604	0.552
	Contrology training	23.10 ± 2.54	21.49	24.71		
CV angle-Pre	Isometric Exercise (Control)	46.05 ± 2.59	44.49	47.62		
	Neck Stabilization training	45.39 ± 4.34	42.77	48.01	0.419	0.661
	Contrology training	44.88 ± 2.27	43.44	46.33		
NPRS-Pre	Isometric Exercise (Control)	6.23 ± 1.09	5.57	6.89		
	Neck Stabilization training	7.54 ± 1.13	6.86	8.22	4.311	0.021*
	Contrology training	6.83 ± 1.19	6.08	7.59		
NDI-Pre	Isometric Exercise (Control)	19.92 ± 5.63	16.52	23.33		
	Neck Stabilization training	25.46 ± 5.14	22.35	28.57	4.053	0.026*
	Contrology training	23.58 ± 4.17	20.94	26.23		

SD: standard deviation; BMI: body mass index; CV: angle: Craniovertebral angle; NPRS: numeric pain rating scale; NDI: neck disability index; *: *p*-value statistically significant.

ficant difference at baseline was found between NPRS (p=0.021) and NDI (p=0.026) (Table I).

Paired sample t-test showed that there was a significant change from pre-values to post-values of craniovertebral angle ($t(48)$=-3.82, p<0.001), NPRS ($t(48)$=7.87, p<0.001) and NDI ($t(48)$=7.96, p<0.001) in the control group. Likewise, there was significant change from pre-values to post-values of craniovertebral angle ($t(48)$=-3.13, p=0.01), NPRS ($t(48)$=11.58, p<0.001) and pre to post NDI ($t(48)$=15.65, p<0.001) in the neck stabilization training group. In Contrology training group a significant change was also found from pre-values to post-values of craniovertebral angle ($t(48)$=-2.81, p=0.02), NPRS ($t(48)$=15.71, p<0.001) and NDI ($t(48)$=16.11, p<0.001) (Table II).

Repeated measure ANOVA revealed that there was a significant time effect for craniovertebral angle (p<0.001) where group effect (p=0.6) and time×group interaction (p=0.15) was found to be non-significant. Repeated measure ANCOVA revealed that there was a significant group effect (p-value <0.001) and time×group interaction (p<0.001) for NPRS whereas the time effect (p=0.35) was found to be non-significant. Similarly, for NDI there was a significant group effect (p<0.001) and time×group interaction (p-<0.001) whereas the time effect (p=0.81) was found to be non-significant (Table III).

Table IV showed a groupwise comparison using post-hoc analysis for three different parameters, including craniovertebral angle (CVA), Numeric Pain Rating Scale (NPRS), and Neck Disability Index (NDI). The results conveyed that while improvement was witnessed in CVA among all the three groups under study displayed improvement; however, it was found statistically insignificant. However, NPRS showed that there was a significant difference between neck isometric exercise and neck stabilization training (p<0.001) as well as Contrology training (p<0.001). Similarly, NDI showed that there was a significant difference between neck isometric exercise and neck stabilization training (p<0.001), neck isometric exercise and Contrology training (p<0.001), and neck stabilization and Contrology training (p<0.001).

Discussion

This study was conducted in a clinical setup on 90 adults between the age group of 18 to 40 years. Out of these 75 subjects were included.

Table II. Paired t-test for comparing craniovertebral angle, NPRS and NDI in neck stabilization, contrology and the control groups.

Outcome Variables	Time	Mean ± SD	*t*-value	95% of confidence interval		*p*-value
				Lower	Upper	
Neck isometric exercise (Control)						
CV Angle	Pre	46.05 ± 2.59	-3.82	-0.93	-0.25	<0.001*
	Post	46.65 ± 2.64				
NPRS	Pre	6.23 ± 1.09	7.87	1.56	2.75	<0.001*
	Post	4.08 ± 1.04				
NDI	Pre	19.92 ± 5.63	7.96	6.59	11.56	<0.001*
	Post	10.85 ± 4.69				
Neck stabilization training						
CVA	Pre	45.39 ± 4.34	-3.13	-2.46	-0.44	0.01*
	Post	46.84 ± 2.81				
NPRS	Pre	7.54 ± 1.13	11.58	4.31	6.31	<0.001*
	Post	2.23 ± 1.17				
NDI	Pre	25.46 ± 5.14	15.65	17.15	22.70	<0.001*
	Post	5.54 ± 1.90				
Contrology training						
CVA	Pre	44.88 ± 2.27	-2.81	-1.34	-0.16	0.02*
	Post	45.63 ± 1.93				
NPRS	Pre	6.83 ± 1.19	15.71	3.51	4.66	<0.001*
	Post	2.75 ± 0.75				
NDI	Pre	23.58 ± 4.17	16.11	13.31	17.52	<0.001*
	Post	8.17 ± 2.17				

SD: standard deviation; CVA: Craniovertebral angle; NPRS: numeric pain rating scale; NDI: neck disability index; *: p-value statistically significant.

Table III. Repeated Measure 3×2 ANOVA or ANCOVA results showing craniovertebral angle, NPRS and NDI at pre-values and post values.

Outcome Variables	Neck isometric Exercise (Control)		Contrology training		Neck stabilization training		Time effect		Time×group interaction		Group effect	
	Pre	Post	Pre	Post	Pre	Post	*p*-value	eta	*p*-value	eta	*p*-value	eta
CVA	46.06 ± 2.59	46.65 ± 2.64	44.88 ± 2.27	45.63 ± 1.93	45.39 ± 4.34	46.84 ± 2.81	<0.001*	0.41	0.15	0.10	0.60	0.03
NPRS	6.23 ± 1.10	4.08 ± 1.04	6.83 ± 1.19	2.75 ± 0.75	7.54 ± 1.13	2.23 ± 1.17	0.35	0.03	<0.001*	0.47	<0.001*	0.47
NDI	19.92 ± 5.63	10.85 ± 4.69	25.46 ± 5.14	5.54 ± 1.90	23.58 ± 4.17	8.17 ± 2.17	0.81	0.002	<0.001*	0.556	<0.001*	0.88

SD: standard deviation; BMI: body mass index; CV: angle: Craniovertebral angle; NPRS: numeric pain rating scale; NDI: neck disability index; *: *p*-value statistically significant.

Table IV. Results of post-hoc pairwise comparisons.

Post Hoc Comparisons - Group			Mean Difference	95% CI for Mean Difference		SE	*t*	Cohen's d	p_{bonf}
				Lower	Upper				
CVA	Isometric Exercise (Control)	Neck Stabilization Training	-0.303	-2.603	1.997	0.940	-0.322	-0.111	1.000
	Isometric Exercise (Control)	Contrology training	1.066	-1.289	3.421	0.962	1.108	0.459	0.826
	Neck Stabilization Training	Contrology training	1.369	-0.994	3.732	0.966	1.418	0.564	0.495
NPRS	Isometric Exercise (Control)	Neck Stabilization Training	2.241	1.211	3.271	0.420	5.330	2.031	<0.001***
	Isometric Exercise (Control)	Contrology training	1.509	0.544	2.474	0.394	3.830	1.653	0.002**
	Neck Stabilization Training	Contrology training	-0.732	-1.706	0.242	0.397	-1.842	-0.739	0.222
NDI	Isometric Exercise (Control)	Neck Stabilization Training	7.397	4.619	10.175	1.134	6.525	2.069	<0.001***
	Isometric Exercise (Control)	Contrology training	4.061	1.380	6.741	1.094	3.712	1.097	0.002**
	Neck Stabilization Training	Contrology training	-3.337	-5.931	-0.743	1.059	-3.152	-1.643	0.010*

* $p<0.05$, ** $p<0.01$, *** $p<0.001$; CVA: Craniovertebral angle; NPRS: numeric pain rating scale; NDI: neck disability index; *: *p*-value statistically significant.

This research examined the effect of neck stabilization and Contrology training on craniovertebral angle, pain, and neck disability in patients with Text Neck Syndrome.

In the present study, pre and post-data on craniovertebral angle, pain, and neck disability of all the three groups were taken. Results of this study show a significant difference in the craniovertebral angle, NPRS and NDI among patients with Text Neck Syndrome. Thus, we can say that the craniovertebral angle, pain and neck disability have improved significantly in both the interventional groups as well as the control group. When compared with the control group, both the experimental group show similar changes for NPRS, but significantly larger improvement for NDI in the neck stabilization group when compared to the Contrology group.

In this study, both neck stabilization and Contrology training had a significant impact on the pain, in patients with Text Neck Syndrome. This is incongruent with previous findings[10] where a comparison was made between neck stability exercises and dynamic exercises in patients with non-specific chronic neck pain (NSCNP), and it was found that neck stability exercises were more effective at reducing pain in NSCNP patients. Another study[17] presented that neck stability exercises showed higher pain improvement when compared with general neck exercises, which is in line with the present study in individuals with chronic neck pain. However, the changes in pain for neck stabilization and Contrology training group were found to be similar. A possible reason for mitigation in the pain intensity could be attributed to Contrology training. It is postulated that structure-specific training results in increased activity in the motor pathways, which causes an inhibiting effect on the CNS's pain centers resulting in reduced perception[18]. In addition, the way pain-relieving exercises work is based on activating the deep cervical muscles to reduce the tension of the superficial muscles. This creates a balance between the two groups, which stimulates the mechanoreceptors and increases sensory nerve activity, which blocks the pain-mediating pathways[8].

The present study found that the craniovertebral angle significantly increased in the neck stabilization, Contrology training, and neck isometric groups. A similar result was found in previous studies[8,12], which showed that six weeks of neck exercises or Contrology training increase craniovertebral angle in chronic mechanical neck pain with FHP. The lowered CVA promotes cervical vertebrae flexion in a forward position, which, if maintained for an extended period, increases the stress on extensor muscles (by raising the external moment arm) and its surrounding connective tissue[19]. According to earlier research[19-21], the persistent stress on the extension muscle and connective tissue in the craniocervical region, which leads to an imbalance in the neck and pain, is the cause of neck pain. Moreover, it has been found that if CVA is 5° smaller than that recorded in individuals without FHP, it can raise stress in the craniocervical region's posterior portion[6]. Consequently, workouts are essential for addressing FHP. This could be because they felt less pain, which made their posture better. Studies indicate that CVA is a significant factor influencing pain in patients with Forward Head Posture[22,23].

Patients who participated in neck stability exercises and Contrology exercises had a statistically significant improvement in their Neck disability index (NDI). Both experimental groups exhibit improvement as the severity of disability decreases from severe to moderate and mild. This is consistent with previous findings[10,14,17,18], which compared stabilization exercise to other forms of general exercise. The same is also supported by other studies[11,24] that compared Contrology exercise to regular exercise and discovered that the Contrology exercise and neck stability groups performed significantly better the other groups. Due to muscle weakness, the inactivity of the cervical muscles is responsible for the impairment. Effective improvement in disability may therefore be contingent on the strengthening of weaker muscles, which reduces discomfort and enhances function[8]. Several studies[10,15,25] demonstrate the effectiveness of neck stability exercises and Contrology exercises. Both exercises have been found to considerably reduce discomfort, neck impairment, and the craniovertebral angle, all of which contribute to an improvement in the quality of life for people with Text Neck Syndrome along with the incorporation of the neck isometrics.

Although this study had significant limitations, it demonstrated high recruitment and the safety of the intervention. Four weeks after the intervention, the results were evaluated. As a result, the study's findings should be used with care. Another drawback of this study was that the researcher was unable to control the participants' use of painkillers on the day of their initial assessment, which could have also affected how well the treatment was working.

Conclusions

This study demonstrated that both neck stability and Contrology exercises enhanced the craniovertebral angle, decreased neck discomfort and impairment, and increased the craniovertebral angle in individuals with Text Neck Syndrome. The two groups had comparable effects on all clinical outcome factors; hence, both exercises are beneficial for treating persons with Text Neck Syndrome. Patients with Text Neck Syndrome benefited more from neck stability exercises than Contrology exercises in terms of raising Craniovertebral angle, reducing discomfort intensity, and improving neck function.

Conflict of Interest

There are no disclosed financial, legal, or political conflicts of interest involving third parties (such as the government, businesses, private foundations, etc.) for any element of the submitted work (including, but not limited to grants and funding, advisory board participation, study design, preparation of the manuscript, statistical analysis, etc.).

Ethics Approval

Ethical approval was obtained from the ethical committee at the Faculty of Allied Health Sciences in accordance with Ethical Principles for Medical Research Involving Humans (WMA Declaration of Helsinki), with reference No.: MRIIRS/FAHS/DEC/2021-M16 dated 9th April 2021.

Informed Consent

Each study participant provided written informed consent.

Acknowledgments

The authors are grateful to the Manav Rachna Institute of Research & Studies for providing the opportunity to plan and develop this research proposal. A Special thanks goes to all the participants who cooperated in the execution of this research work so smoothly.

Data Availability

The authors possess the data utilized for analysis, which is readily available and can be reproduced upon request.

Funding

The authors are grateful to Deanship of Scientific Research, Majmaah University for funding this study through Deanship of Scientific Research vide Project No.: RGP-2019-35.

ORCID ID

S. Bharal: 0000-0002-0613-0848
M. R. Rizvi: 0000-0001-8424-7163
M.M. Alqahtani: 0000-0003-2006-9032
A. Sharma: 0000-0002-8742-381X
I. Ahmad: 0000-0002-6012-9207
M.L. Al-Otaibi: 0000-0002-5958-9820
R.A. Alajam: 0000-0001-5110-289X
M.M. Alshehri: 0000-0003-0028-0957
M.A. Shaphe: 0000-0002-6046-9543
F. Ahmad: 0000-0002-1189-2206
M. Miraj: 0000-0001-8590-0531
M. Alzhrani: 0000-0002-4233-9673
A.D. Alanazy: 0000-0002-5604-1835
G.M. Shawky: 0000-0003-0148-2227.

References

1) Agrawal YK, Hande D. Effect of activation of deep neck flexor muscle exercise on neck pain due to smartphone addiction. Int Multidiscip Res J 2017; 4: 489-492.
2) Neupane S, Ali U, Mathew A. Text neck syndrome-systematic review. Imp J Interdiscip Res 2017; 3: 141-148.
3) Kim H-J, Kim J-S. The relationship between smartphone use and subjective musculoskeletal symptoms and university students. J Phys Ther Sci 2015; 27: 575-579.
4) Sathya P, Tamboli SA. Prevalence of text neck syndrome in young-adult population. Int J Med Exerc Sci 2020; 6: 749-759.
5) Kumari S, Kumar R, Sharma D. Text Neck Syndrome: The Pain of Modern Era. J Health Sci Res 2021; 11: 161-165.
6) Kim D-H, Kim C-J, Son S-M. Neck pain in adults with forward head posture: effects of craniovertebral angle and cervical range of motion. Osong Public Health Res Perspect 2018; 9: 309.
7) Akodu AK, Akinbo SR, Young QO. Correlation among smartphone addiction, craniovertebral angle, scapular dyskinesis, and selected anthropometric variables in physiotherapy undergraduates. J Taibah Univ Medical Sci 2018; 13: 528-354.
8) Suvarnnato T, Puntumetakul R, Uthaikhup S, Boucaut R. Effect of specific deep cervical muscle exercises on functional disability, pain intensity, craniovertebral angle, and neck-muscle strength in chronic mechanical neck pain: a randomized controlled trial. J Pain Res 2019; 12: 915.
9) Shaghayeghfard B, Ahmadi A, Maroufi N, Sarrafzadeh J. Evaluation of forward head posture in sitting and standing positions. Eur Spine J 2016; 25: 3577-3582.
10) Kaka B, Ogwumike OO. Effect of neck stabilization and dynamic exercises on pain, disability and fear avoidance beliefs in patients with non-specific neck pain. Physiotherapy 2015; 101: e704.

11) de Araujo Cazotti L, Jones A, Roger-Silva D, Ribeiro LHC, Natour J. Effectiveness of the Pilates method in the treatment of chronic mechanical neck pain: a randomized controlled trial. Arch Phys Med Rehabil 2018; 99: 1740-1746.

12) Lee S-M, Lee C-H, O'Sullivan D, Jung J-H, Park J-J. Clinical effectiveness of a Pilates treatment for forward head posture. J Phys Ther Sci 2016; 28: 2009-2013.

13) Gupta BD, Aggarwal S, Gupta B, Gupta M, Gupta N. Effect of deep cervical flexor training vs. conventional isometric training on forward head posture, pain, neck disability index in dentists suffering from chronic neck pain. Journal of clinical and diagnostic research: J Clin Diagnostic Res 2013; 7: 2261.

14) Akodu A, Nwanne C, Fapojuwo O. Efficacy of neck stabilization and Pilates exercises on pain, sleep disturbance and kinesiophobia in patients with non-specific chronic neck pain: A randomized controlled trial. Bodyw Mov Ther 2021; 26: 411-419.

15) Akodu A, Nwanne C, Fapojuwo O. Efficacy of neck stabilization and Pilates exercises on pain, sleep disturbance and kinesiophobia in patients with non-specific chronic neck pain: A randomized controlled trial. J Bodyw Mov Ther 2021; 26: 411-419.

16) Shah J, Soni K. Effectiveness of Pilates along with Conventional Exercise Program and Conventional Exercise Program Alone in Subjects with Text Neck Syndrome. Int J Sci Res 2021; 10: 1322-1326.

17) Farrar JT, Young Jr JP, LaMoreaux L, Werth JL, Poole RM. Clinical importance of changes in chronic pain intensity measured on an 11-point numerical pain rating scale. Pain 2001; 94: 149-158.

18) Dusunceli Y, Ozturk C, Atamaz F, Hepguler S, Durmaz B. Efficacy of neck stabilization exercises for neck pain: a randomized controlled study. J Rehabil Med 2009; 41: 626.

19) Yip CHT, Chiu TTW, Poon ATK. The relationship between head posture and severity and disability of patients with neck pain. Man Ther 2008; 13: 148-154.

20) Chiu TT, Lam T-H, Hedley AJ. Correlation among physical impairments, pain, disability, and patient satisfaction in patients with chronic neck pain. Arch Phys Med Rehabil 2005; 86: 534-540.

21) Côté P, Hogg-Johnson S, Cassidy JD, Carroll L, Frank JW. The association between neck pain intensity, physical functioning, depressive symptomatology and time-to-claim-closure after whiplash. J Clin Epidemiol 2001; 54: 275-286.

22) Contractor ES, Shah S, Dave P. To study the immediate effect of suboccipital muscle energy technique on craniovertebral angle and cranio-horizontal angle on subjects with forward head posture. Int J Health Sci Res 2019; 9: 83.

23) Sharma A, Rizvi M, Kumari S, Sharma P. Comparando o efeito da liberação miofascial e técnica de energia muscular no ângulo craniovertebral e cefaleia em pacientes com cefaleia tensional. Revista Pesquisa em Fisioterapia 2022; 12:e4799: 1-10.

24) Dunleavy K, Kava K, Goldberg A, Malek MH, Talley SA, Tutag-Lehr V, Hildreth J. Comparative effectiveness of Pilates and yoga group exercise interventions for chronic mechanical neck pain: quasi-randomised parallel controlled study. Physiotherapy 2016; 102: 236-242.

25) Mallin G, Murphy S. The effectiveness of a 6-week Pilates programme on outcome measures in a population of chronic neck pain patients: a pilot study. J Bodyw Mov Ther 2013; 17: 376-384.