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Effectiveness Of Neck Stabilization Training with Conventional Physical Therapy for Text Neck Syndrome: A Randomized Clinical Trial

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ABSTRACT

Background of the study: Text neck syndrome, a prevalent cervical disorder caused by excessive smartphone use, results in pain and strain in the neck, shoulders, and thoracic region. This study aims to assess the effectiveness of a neck stabilization training program in improving cervical pain, disability, cranio-vertebral angle, range of motion, and cervical endurance.

Methodology: A randomized controlled trial was carried out at Aizaz Rehab Clinic, Mandra, Pakistan. Twenty-six participants were selected based on predefined inclusion and exclusion criteria and were randomly assigned to two groups. Group A (n=13) received neck stabilization training in addition to conventional physiotherapy, while Group B (n=13) received only conventional therapy.

Results: At baseline, both groups were homogenous (P>0.05). Between-group analysis showed significant improvements (P<0.05) in the experimental group for pain, NDI, CVA, cervical motions, and biofeedback measures. Within-group analysis revealed improvements in all variables for both groups (P<0.05) at follow-up, except for endurance of cervical flexors, rotators (left and right), and right lateral flexors, which were not statistically significant.

Conclusions: The neck stabilization training is effective in reducing pain and disability, while improving ROM, craniovertebral angle and pressure biofeedback of cervical muscles in text-neck syndrome population.

Keywords: *cervical pain, neck pain, mobile, smart phone, neck disability, text neck*

INTRODUCTION

Text Neck Syndrome, also referred to as 'Turtle neck Syndrome' or 'Anterior Head Syndrome,' was identified after recognizing cervical-related injuries in mobile device users. It is characterized by a collection of signs and symptoms, including repetitive stress, strain, and pain in the neck, shoulders, and thoracic region, resulting from prolonged smartphone use[1,2]. The most prevalent clinical presentation of the text neck syndrome includes stiffened cervical spine, muscle soreness, difficulty in cervical movements, localized or diffused cervical pain, and headache in the sub-occipital region. According to the epidemiological studies done to find it's frequency in different countries, occurrence in Saudi Arabia was reported as 68% in which 50% had mild neck disability, 17.1% had moderate neck disability, and 2.6% had severe neck disabilities[3].

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Another study of Indian students at university, the text neck syndrome severity was stated as 47% having cervical discomfort and pain while the remaining 44% had mild to severe cervical disability[4]. In a cross-sectional survey of Sharif Medical and Dental College Pakistan, 42% of the students had text neck syndrome[5]. Likewise, text neck syndrome was identified in 25.5% students enrolled in Doctor of Physical Therapy program at Khyber Medical University Peshawar, Pakistan[6].There are three ways to manage the text neck syndrome; primary, secondary and clinical. Primary prevention focuses on educating general public. Secondary prevention targets the diagnosed population to avoid recurrence. Clinical treatment, primarily spinal stabilization program, aims to limit pain, restore and maximize the physiological function, and prevent future injuries. Core components of this training include postural re-education, cranio-cervical isometrics exercises, stretching of interscapular, shoulder, and upper extremity muscles, resistance training, and against gravity active cervical movements[7,8]. Multiple researches were conducted to test the efficacy of spinal stabilization. These studies collectively investigate the effects of neck stabilization exercises on various outcomes such as pain, balance, cervical range of motion, and quality of life across different populations, including musicians, elderly individuals with upper cross syndrome, tailors, and community-dwelling elders. The findings generally indicate that neck stabilization exercises significantly improve pain, balance, and cervical range of motion[9-11], though results on cranio-vertebral angle and quality of life are mixed, with some studies showing non-significant improvements[9,12]. Unfortunately, no evidence protocol has been published that has particularly targeted the text neck syndrome population in a holistic approach. This study emphasizes the effectiveness of combining neck stabilization training with conventional physiotherapy in managing text neck syndrome, compared to the standard physiotherapy protocol.

METHODOLOGY

A randomized clinical trial (registered on clinicaltrials.gov, NCT05479279) was conducted at Aizaz Rehab Clinic in Mandra, Pakistan, over a period of four months, from January 2022 to April 2022. The study began following approval from the Institutional Review Board and Ethics Committee, and written informed consent was obtained from all participants prior to the study. The sample size was calculated by Open epi v3 software with NDI variable values. Participants were approached through purposive sampling technique. After screening, 26 patients aged between 18 – 30 years, using smart phones and tablets >3 hours per day with duration of smart gadget usage >6 months, having NDI score ranging from 5 – 50 points, and having trigger points of Cervical Muscles [trapezius (upper, middle and lower) levator scapulae and scalene muscles] were selected. Patients having neck pain other than text neck syndrome were excluded from this study. Participants were randomly assigned using the sealed envelope method and a computerized random number generator. The allocation sequence was prepared by an individual not directly involved in the study. Consecutive random numbers were written on index cards and placed in thick, opaque sealed envelopes prior to the study. After obtaining informed consent from the patients, the treating physiotherapist opened the envelopes and administered the assigned treatment. The study was single-blinded, meaning participants were unaware of which intervention group they were assigned to. All participants underwent 18 sessions over six weeks, with three sessions per week. Group A received neck stabilization training in addition to conventional therapy, while Group B received only conventional therapy, which included hot packs, TENS, and cervical muscle stretching. Goniometer was used to measure the cervical range of motion (Flexion, Extension, Rotation and Lateral Flexion of both sides) and Cranio-vertebral angle whereas pressure biofeedback was used to assess the endurance of cervical muscles (Flexors, Extensors and Rotators). Furthermore, level of disability in patients was evaluated using NPRS [13,14] while Intensity of pain was measured by NDI[15,16]. A physiotherapist collected data before and after the intervention. There were no dropouts during the six-week treatment period. The data was analyzed by using SPSS version 22 (Statistical Procedure of Social Sciences). The paired sample t-test and

Wilcoxon signed-rank test were employed to analyze changes within the groups for normally distributed data and non-normally distributed data (Cervical Flexion), respectively. Mann-Whitney U-Test was used to determine the differences between the groups for non-normal data (Cervical Flexion), while the independent t-test was used for comparing differences between the groups in normal data. $P \leq 0.05$ was considered a statistically significant value. Results were described in the form of tables and graphs.

RESULTS

A total of 26 participants were evaluated (experimental= 13, Control=13), the mean age was 24.53 ± 3.57 years for group A, and 23.57 ± 3.54 years for group B. The mean BMI of Group A was 24.35 ± 3.06 and for Group B it was 25.18 ± 2.72. Among the selected individuals, majority were female (76.9% in Group A and 61.5% in Group B), the remaining were males (23.1% in Group A and 38.5% in Group B).

	Mean ± SD	**Mean ± SD**
Age (years)	24.53 ± 3.57	23.57 ± 3.54
Height (cm)	169.43 ± 8.9 cm	171.96 ± 8.7 cm
Body Mass Index (kg/m^2)	24.35 ± 3.06 kg/m^2	25.18 ± 2.72 kg/m^2
Weight (kg)	72.0 ± 6.55 kg	71.61 ± 6.72 kg

Table 1. Demographic characteristics of participants

At pre-test level, NPRS, NDI, CVA, Cervical ROM (Flexion, Extension, left rotation, Right rotation, left lateral flexion, right lateral flexion) and Endurance (Flexion, Extension, left rotation, Right rotation, left lateral flexion, right lateral flexion) were recorded. Follow-up was done for the said outcome measures after six weeks of intervention. Patients also followed home exercise intervention during treatment period. Normality was tested through Shapiro-Wilk test. All variables were normal except Cervical Flexion ROM which was non-normal ($p<0.003$). In the group analysis, comparisons were made using the Independent t-test for all variables except Cervical Flexion, as detailed in Table 2. After treatment, there was a significant improvement in pain, range of motion (ROM), craniovertebral angle (CVA), disability, and endurance scores at the ,follow-up ($P<0.05$). The analysis of Cervical Flexion ROM was conducted using the Mann-Whitney U-Test, which also revealed significant improvement after treatment ($P<0.05$), as illustrated in Figure 1.

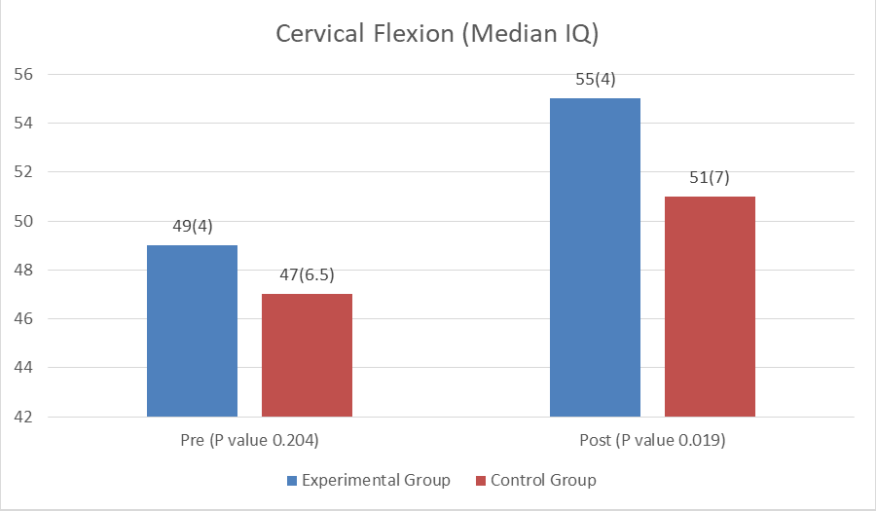

Figure 1. Results of Mann Whitney-U Test between the groups for Cervical Flexion

Variables		Experimental Group (A)	Control Group (B)	Mean Difference	P-value
NPRS	Pre	6.76 ± 1.42	6.15 ± 1.2	-0.615	**0.247**
	Post	2.61 ± 0.96	4.15 ± 0.80	1.53	**0.001***
NDI	Pre	24.0 ± 8.86	22.61 ± 9.9	-1.38	**0.712**
	Post	8.53 ± 4.13	17.23 ± 9.2	8.69	**0.005***
Pre-CVA	Pre	42.30 ± 4.21	43.38 ± 4.57	1.07	**0.538**
	Post	59.53 ± 4.99	52.46 ± 5.82	-7.07	**0.003***
Extension	Pre	62.76 ± 5.18	62.53 ± 4.89	-0.23	**0.908**
ROM	Post	71.84 ± 4.46	66.23 ± 5.15	-5.76	**0.007***
Right rotation	Pre	74.38 ± 4.89	72.0 ± 5.11	-2.38	**0.236**
ROM	Post	80.84 ± 5.85	75.07 ± 5.21	-6.01	**0.014***
Left rotation	Pre	73.53 ± 4.90	71.07 ± 5.11	-2.46	**0.222**
ROM	Post	81.76 ± 5.40	75.76 ± 5.67	-1.84	**0.011***
Right lateral	Pre	37.69 + 2.52	38.84 + 2.33	1.15	**0.239**
Flexion ROM	Post	43.61 + 0.96	41.76 + 2.08	-4.76	**0.010***
Left lateral	Pre	38.69 + 2.52	39.84 + 2.33	1.15	**0.240**
flexion ROM	Post	44.62 + 0.97	42.77 + 2.09	-4.0	**0.008***
Flexors	Pre	26.92 + 2.06	26.23 + 1.58	-0.69	**0.347**
Endurance	Post	31.46 + 1.98	26.69 + 1.75	-3.38	**0.001***
Extensors	Pre	25.61 + 1.66	26.30 + 2.05	0.69	**0.354**
Endurance	Post	31.38 + 1.90	27.38 + 1.80	-3.0	**0.001***
Right rotator	Pre	19.61 + 1.75	18.53 + 2.02	-1.07	**0.161**
Endurance	Post	22.31 + 1.84	18.92 + 2.39	-1.84	**0.001***
Left rotators	Pre	19.46 + 1.39	18.38 + 2.14	1.23	**0.142**
Endurance	Post	21.76 + 1.48	18.76 + 1.58	-1.61	**0.001***
Right lateral	Pre	22.38 + 1.50	23.61 + 1.85	-1.30	**0.075**
flexors	Post	25.76 + 2.0	24.92 + 2.39	8.69	**0.044***
Endurance					
Left lateral	Pre	23.62 + 1.85	22.30 + 1.54	-1.38	**0.062**
flexors	**Post**	**24.92 + 1.70**	**23.31 + 1.71**	**-1.61**	**0.024***
Endurance					

Table 2. Results of Independent T-test between the groups

Results of within Group analyses (Table 3), was conducted by paired- t test for pain, ROM, CVA, disability and endurance scores. For within Group analyses of Cervical Flexion ROM, Wilcoxon Rank test was used, shown in figure 2. Within-group analysis results revealed statistically significant improvements in all variables for both groups at follow-up ($P<0.05$), except cervical flexors endurance, cervical right rotators endurance, cervical left rotators endurance and cervical right lateral flexors endurance which were statistically non-significant.

Variables		Baseline Mean±SD	Post-Intervention Mean±SD	P-value
NPRS	Group A	6.76 ± 1.42	2.61 ± 0.96	0.001*
	Group B	6.15±1.2	4.15±0.80	0.001*
NDI	Group A	24.0 ± 8.86	8.53 ± 4.13	0.001*
	Group B	22.61±9.9	17.23±9.2	0.001*
CVA	Group A	42.30 ± 4.21	59.53 ± 4.99	0.001*
	Group B	43.38±4.57	52.46±5.82	0.001*
Cervical extension ROM	Group A	62.76 ± 5.18	71.84 ± 4.46	0.001*
	Group B	62.53±4.89	66.23±5.15	0.001*
Cervical right rotation ROM	Group A	74.38 ± 4.89	80.84 ± 5.85	0.001*
	Group B	72.0±5.11	75.07±5.21	0.001*
Cervical left rotation ROM	Group A	73.53 ± 4.90	81.76 ± 5.40	0.001*
	Group B	71.07±5.11	75.7±5.67	0.001*
Cervical right lateral flexion ROM	Group A	37.69 ± 2.52	43.61 ± 0.96	0.001*
	Group B	38.84±2.33	41.76±2.08	0.001*
Cervical left lateral flexion ROM	Group A	38.69 ± 2.52	44.62 ± 0.97	0.001*
	Group B	39.84±2.33	42.77±2.09	0.001*
Cervical flexors Endurance	Group A	26.92 ± 2.06	31.46 ± 1.98	0.001*
	Group B	26.23±1.58	26.69±1.75	0.139
Cervical extensors Endurance	Group A	25.61 ± 1.66	31.38 ± 1.90	0.001*
	Group B	26.30±2.05	27.38±1.80	0.020*
Cervical right rotators Endurance	Group A	19.61 ± 1.75	22.31 ± 1.84	0.001*
	Group B	18.53±2.02	18.92±2.39	0.209
Cervical left rotators Endurance	Group A	19.46 ± 1.39	21.76 ± 1.48	0.001*
	Group B	18.38± 2.14	18.76± 1.58	0.137
Cervical right lateral flexors Endurance	Group A	22.38 ± 1.50	25.76 ± 2.0	0.001*
	Group B	23.61± 1.85	24.92± 2.39	0.527
Cervical left lateral flexors Endurance	Group A	23.62 ± 1.85	24.92 ± 1.70	0.001*
	Group B	22.30 ± 1.54	23.31± 1.71	0.001*

Table 3. Results of Paired T-Test for within the group's comparison

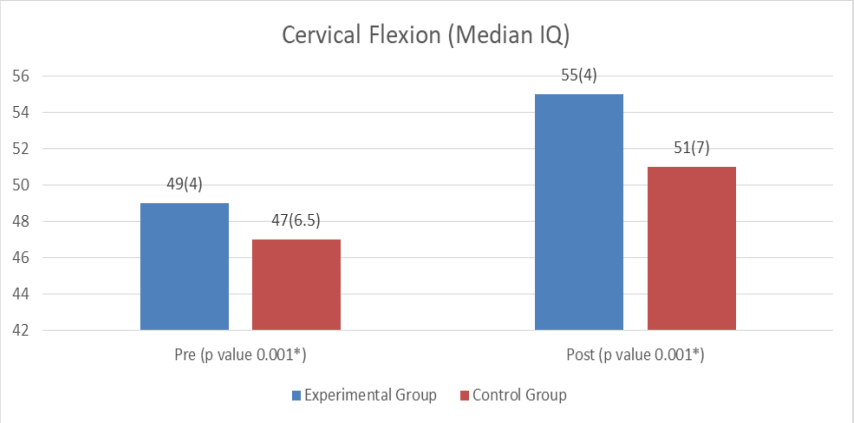

Figure 2. Results of Wilcoxon-Rank Test within the groups for Cervical Flexion

DISCUSSION

The aim of this research was to compare the effectiveness of neck stabilization training and conventional therapy in treating text neck, specifically assessing their impact on pain, neck disability, craniovertebral angle, range of motion, and cervical muscle endurance. To our knowledge, this study is first that has structure defined neck stabilization treatment protocol and evaluated the effectiveness. In current study, the experimental group with neck stabilization training participants showed statistical significance (P=0.001) in lowering the pain as compared to the control group that received conventional physical therapy. In a similar study by Ho-Jin et al. (2020), a single-blinded randomized controlled trial examined the effects of combining thermotherapy with neck stabilization exercises on chronic nonspecific neck pain. The results showed that salt pack therapy combined with neck stabilization exercises led to significant reductions in pain intensity both at rest ($p < 0.001$) and during movement ($p < 0.001$) over time. The intervention group exhibited a notable decrease in pain intensity at rest ($p < 0.001$) and during movement ($p < 0.001$) after the treatment. The control group also experienced significant reductions in pain intensity at rest ($p = 0.009$) and during movement ($p = 0.001$)[17].Regarding the cervical disability measure via Neck Disability Index the neck stabilization showed significant difference (P=0.005) in lowering the disability level. This finding is also supported by a study conducted by Rasheedah Adebola Zibiri et al (2019) in which participants receiving neck stabilization training showed significant result in reducing neck disability[18]. However, all the treatment groups in the study received combined treatment and neck stabilization training was added with muscle energy technique. The analysis showed significant changes in pain severity (P = 0.01, 0.004), neck disability (P = 0.01, 0.001), and sleep disturbance (P = 0.02, 0.002) at the 4th and 8th weeks following the intervention. Control group also showed improvement in lowering the disability level which is justifiable because conventional physical therapy has been validated as effective treatment to decrease disability[19].In experimental group, all the cervical range of motion including cervical flexion, extension, lateral flexion (right and left), and rotation (right and left) improved (P<0.05). Similar findings were also observed in a single arm experimental pre-post study by Yi-Liang Kuo et al (2020); where all range of motion at cervical spine showed significant improvement expect cervical flexion. After the intervention, an improvement in the cervical range of motion was observed ($p < 0.05$)[20]. Furthermore, in control group conventional therapy was effective in improving the range of motion at cervical spine which is supported by Lee Jae-Doo et al (2020) stating that a group that received conventional physical therapy treatment showed improvement in range of motion. Marked changes in cervical joint range of motion (ROM) were observed between pre- and post-intervention for the neuromuscular control group, SS group, and stabilization exercise group. Notably, there was a considerable difference in left cervical rotation

between the pre- and post-intervention assessments ($p < 0.01$)[21].In Current study, the neck stabilization training also considerably improved CVA in both groups ($P \leq 0.01$), similar to experimental pre-post study by Yi-Liang Kuo et al (2020) which showed that after intervention CVA increased by 1.8° ($p < 0.01$)[20].Moreover, this study reported that neck stabilization training program improved cervical muscle endurance in all muscle groups ($P<0.05$). Findings of an earlier investigation by Lee Jae-Doo et al (2020) lend further credibility to the hypothesis that receiving neck stabilization training shows improvement in muscle endurance[21]. While considering the control group, only in few muscle groups, the endurance was enhanced including cervical extensors ($P=0.139$) and cervical left lateral flexors ($P=0.001$). These findings are justifiable with evidence-based studies that isometric muscle training improves the muscular endurance; and isometrics are integral part of neck stabilization training program[22, 23]. Similarly, neck stabilization training is consisted of Thera Band resistance training and antigravity resistance training which has proved their efficacy in improving endurance[24, 25].

Limitations

The study lacked in blinding of therapists and outcome measures, therefore risk for biasness exists related to performance and measurements. The study sample was small (n=13) and data was taken from a single setting. Short Follow up period may not have been sufficient to observe significant improvements in outcomes. The study did not utilize objective tools, such as wearable devices, which may have limited the sensitivity of the outcomes.

Recommendations

Further studies should be conducted to determine effectiveness of neck stabilization in other patients such as with non-specific neck pain and geriatric population. RCTS should be conducted with double and triple blinded trials and the results should be generalized to an increased sample size.Incorporating objective assessment tools, including wearable devices, could improve accuracy in measuring outcomes.Longer follow-up periods should be included to assess the sustainability of the intervention effects over time.

CONCLUSION

This study revealed that the neck stabilization training is beneficial and effective for reducing pain and disability while also improving range of motion, craniovertebral angle and endurance of cervical muscles in text neck syndrome population. Moreover, conventional physical therapy was also found effective in some of the mentioned outcomes but significant results were observed in experimental group with neck stabilization training program.

AUTHORS' CONTRIBUTION:

The following authors have made substantial contributions to the manuscript as under:
Conception or Design: Zainab Noor Qazi,
Acquisition, Analysis or Interpretation of Data: Zainab Noor Qazi. Sana Sabir, Wajeeha Nauman Qureshi
Manuscript Writing & Approval: Zainab Noor Qazi, Sana Sabir, Wajeeha Nauman Qureshi, Sana Javaid

All authors acknowledge their accountability for all facets of the research, ensuring that any concerns regarding the accuracy or integrity of the work are duly investigated and resolved.

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