RESEARCH ARTICLE

COMPARE THE EFFECTS OF STRENGTHENING EXERCISES WITH AND WITHOUT SOFT TISSUE MOBILIZATION FOR THE MANAGEMENT OF TENSION NECK SYNDROME IN FEMALES: A RANDOMIZED CONTROLLED

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ABSTRACT

Background: Tension neck syndrome (TNS) is a prevalent condition worldwide. Soft tissue mobilization and strengthening exercises are used in physiotherapeutic rehabilitation of the musculoskeletal disorders. **Objective:** To compare the effects of strengthening exercises with and without soft tissue mobilization (STM) for pain and disability reduction in females with TNS. **Methods:** A single-blinded, parallel-group randomized controlled trial was conducted at the National Institute of Rehabilitation Medicine, Pakistan, from April to July 2016. A total of n=30 females, aged 30-70 years, were recruited through non-probability convenient sampling technique, and randomly allocated to the experimental and control group. The experimental group received STM and neck isometric strengthening exercises (NISE), whereas the control group received neck isometric strengthening exercises only. The Numeric Pain Rating Scale (NPRS) was used to assess the pain intensity, while Neck Disability Index (NDI) was used for the neck-related disability. The data was collected at the baseline, after the 4th session and after the 8th session. The repeated measure analysis of variance (RM ANOVA) was used to analyse within the group changes, while the independent t-test was used to analyse the differences between the groups. The data was analysed by using SPSS version 21. **Results:** The mean age of the study participants was 47.9 ± 8.95 years. Within groups' changes showed that pain intensity, individual items of NDI and its total score showed significant improvement in both the groups from the baseline to the 8th session ($p \leq 0.05$). After the 8th session, the experimental group showed more significant reduction ($p \leq 0.05$) in pain intensity and neck disability as compared to the control group. **Conclusions:** Soft tissue mobilization when combined with neck isometric strengthening exercises was more effective than exercises alone for reducing the pain intensity and disability in females with tension neck syndrome.

Keywords: Neck pain, physical therapy, soft tissue mobilization, strength training

INTRODUCTION

Tension neck syndrome (TNS) can be defined as localized myofascial pain in the neck and shoulder region[1,2] without any past medical history of degenerative disorders, herniated cervical disc, or trauma. Individuals with TNS usually complain of pain, stiffness, tenderness, fatigue, muscle spasm, and tender spots in the neck muscles, especially palpable on the trapezius or sternocleidomastoid muscles, which reduce the neck ranges of motion and functional ability of the neck and shoulder musculature[1,3]. TNS frequently presents as chronic neck pain[4] which is a common condition with a yearly prevalence of 16.7% to 75.1% of the general population[5], and it is the leading cause of disability worldwide[6].

Neck pain is the most common musculoskeletal disorder among intensive computer users, for example, software professionals[7]. School teachers have also been commonly seen to have neck pain at some point during their lives[8]. Chronic neck pain can occur due to various reasons, including abnormalities in the neck muscles, synovial joints, and intervertebral discs together with cervical dura mater, vertebral artery, and infections[9]. Repetitive overloaded activities, bad ergonomics, psychosocial factors, and forward head posture are common contributing factors[10,11]. Forward head posture puts excessive load on the neck musculature, which results in the shortening of sternocleidomastoid, scalenus anterior and upper trapezius, and weakness of levator scapulae and semispinalis capitis muscles[12,13]. In the upper quadrant, postural muscles in general and the upper trapezius muscle in particular, are most affected by soft tissue problems in the form of myofascial trigger points. However, in most cases of neck pain, it is difficult to identify a specific cause and is simply classified as soft tissue rheumatism or muscular, mechanical, or postural neck pain[14].

As compared to males, females are more prone to have the condition, with the highest prevalence reported in middle-aged women[15,16]. Various reasons have been determined for the higher

prevalence of chronic neck pain in females than males, including lower muscular strength, pressure pain threshold, sleep quality, and higher levels of psychological issues such as anxiety and depression in women as compared to men[17]. Physiotherapy, spinal manipulation, massage, yoga, acupuncture, muscle relaxants, and non-steroidal anti-inflammatory drugs are the common treatment options available for neck pain[6]. Physiotherapy includes a variety of approaches including soft tissue mobilization (STM) and therapeutic exercises which are commonly used for the management of TNS[18].STM, also known as muscle mobilization or fascial mobilization, is a commonly used technique for managing tight muscles and cervical radiculopathy[19,20].It consists of two methods, i.e. manual and instrumental, both of which have been determined to be equally effective for pain reduction, improvement in the range of motion, and function[21].Strengthening exercises have also shown effectiveness for neck pain reduction[22].

Although many studies have been conducted on patients with neck pain, there is a paucity of evidence on the comparative effectiveness of neck strengthening exercises with and without STM for females with nonspecific chronic local neck pain. Therefore, the purpose of this pragmatic clinical trial was to compare the effects of neck isometric exercises when given with and without the STM for pain and disability in females with TNS.

METHODOLOGY

A single-blinded, parallel-group randomized controlled trial, registered with clinicaltrials.gov (CTR #: NCT05227963) was conducted at the National Institute of Rehabilitation Medicine (NIRM), Islamabad, Pakistan, from April 2016 to December 2016. The study was initiated after the ethical approval from the institutional review board (IRB), Isra University, Islamabad (ID: 1309-PDPT-012). A written informed consent was taken from the participants, and they were assured about the confidentiality of the data before the study as a statement of ethical principles for medical research involving human subjects as given in the Declaration of Helsinki.

A total of n=47 females with chronic neck pain were assessed for eligibility, who visited NIRM during the recruitment period. However, n=30 participants fulfilled the inclusion criteria and showed a willingness to participate in the study and were thus recruited through a non-probability convenient sampling technique. The participants were randomly allocated to the experimental (n= 15) and control (n=15) group through the lottery method (figure 1).

The inclusion criteria were females, aged 30-70 years with chronic (more than three months) localized mechanical neck pain and a negative Spurling test (assessed by a physiotherapist), while individuals were excluded if they reported having any neurological condition, radicular pain, fracture, or trauma in the neck region, spinal deformity, malignancy, tumours, or any inflammatory condition.

Both the groups received 8 interventional sessions i.e., 4 sessions per week for two weeks. Each session lasted 45 minutes. The experimental group received STM of the sternocleidomastoid, upper trapezius, scalene, and the prevertebral muscles. The STM technique included sustained pressure, unlocking spiral, direct oscillation, perpendicular mobilization, parallel mobilization, perpendicular drumming, and friction massage for a minute followed by a release for 30 seconds in the sitting position[20]. Each technique was repeated three times in each session for 25 minutes. Additionally, neck isometric strengthening exercises (NISE) were performed in flexion, extension, side bending, and rotation for the sternocleidomastoid, upper trapezius, scalene, and the prevertebral muscles were also performed in the sitting position. The duration of the neck isometric exercises was 20 minutes, and each isometric exercise was held for 10 seconds followed by rest for the same time duration. Every muscle group was isometrically contracted 8 times in each session within the available ROM. The control group received neck isometrics strengthening exercises (NISE) only for the same muscles and with the same protocol as the experimental group for 20 minutes.

The general demographic data and past medical history were collected from the participants through a self-structured questionnaire. Spurling test was used for the evaluation of non-radiculopathy cases, which is a valid and reliable tool to assess the anatomical integration of the cervical spine[23].Numeric Pain Rating Scale (NPRS)

was used to assess the pain intensity,[24] while Neck Disability Index (NDI) was used to assess the neck-related disability[25].The data was collected at the baseline, after the 4th session, and after the 8th session by the physiotherapist.

The descriptive statistics, including age and body mass index (BMI), were presented as mean and standard deviation. As the data met the assumption of the parametric test, the repeated measure analysis of variance (RM ANOVA) with pairwise comparison was used to analyse within the group changes. The independent t-test was used to analyse the statistical differences between the two study groups. The data was analysed by using SPSS version 21 and the level of significance was set at 95% (*p≤0.05).*

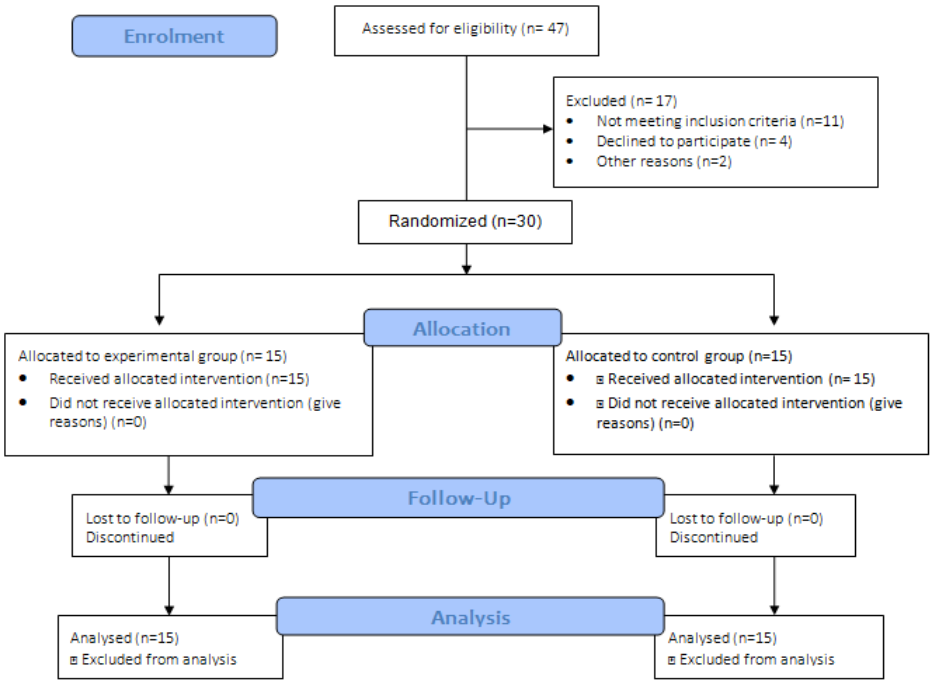

Figure: 1 Consort Diagram

RESULTS

A total of n=30 females, aged 30 to 70 years, participated in the study. The mean age of the study participants was 47.9 ± 8.95 years. Most of the participants were overweight (n=16) and obese (n=7), while n=7 was normal and n=1 was underweight. The mean BMI of n=30 participants was 27.27±5.22 kg/m^2. In the STM group, 3 (10%) patients had their symptoms for more than 3 months, 4 (13.33 %) had since the last 5-8 months, 1 (3.33 %) had since the last 9-12 months, and 7 (23.33 %) patients had symptoms for more than a year. In the control group, 3 (10%) patients had their symptoms for more than 3 months, 2 (6.66 %) had since the last 5-8 months, 3 (10%) had since the last 9-12 months, and 7 (23.33 %) patients had symptoms for more than a year.

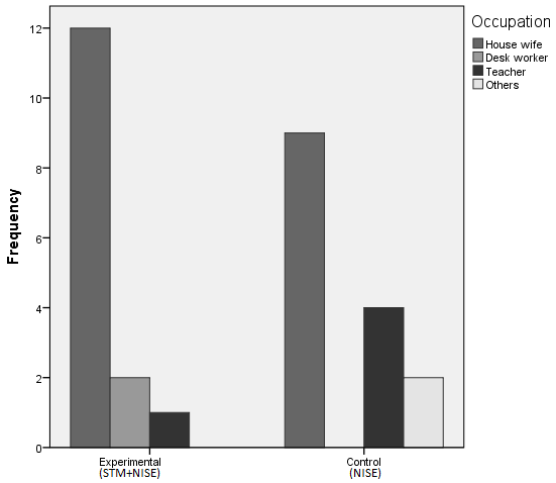

Figure 2: Frequency of the Participants Based on Their Profession

Within groups' changes showed that the pain intensity, individual items of NDI and its total score showed a significant improvement (p ≤ 0.05) in both the groups from the baseline to the 8th session (Table 2)

Table 1: Within-group Changes in NPRS and NDI

NDI Items	No. of Sessions	Experimental Group Mean ± Std	Experimental Group MD/F(df)	Experimental Group p-value	Control Group Mean ± Std.	Control Group MD/F(df)	Control Group p-value
NPRS	Baseline	7.20+ 1.32	3.40	0.00[a***]	7.47+1.64	2.33	0.00[a***]
	4th session	3.80+1.70	2.93	0.00[b***]	5.13+1.30	1.93	0.00[b***]
	8th session	0.87+1.19	226.6(1.9)	0.00[c***]	3.20+1.61	76.48(1.48)	0.00[c***]
Pain intensity	Baseline	3.20±0.77	1.4	0.00[a***]	3.33±0.82	0.80	0.00[a***]
	4th session	1.80±0.68	1.26	0.00[b***]	2.53±0.10	0.87	0.01[b*]
	8th session	0.53±0.64	161.7(1.8)	0.00[c***]	1.67±0.82	23.37(1.78)	0.00[c***]
Personal care	Baseline	2.53±1.06	1.13	0.00[a***]	2.80±0.68	0.67	0.00[a***]
	4th session	1.40±0.99	0.80	0.03[b*]	2.13±0.64	0.60	0.10[b]
	8th session	0.60±0.74	35.96(1.6)	0.00[c***]	1.53±0.74	16.94(1.61)	0.00[c***]
Lifting	Baseline	3.27±0.88	0.80	0.00[a***]	3.53±0.74	0.73	0.00[a***]
	4th session	2.47±0.99	1.27	0.00[b***]	2.80±0.68	0.73	0.00[b***]
	8th session	1.20±1.21	26.18(1.3)	0.00[c***]	2.07±0.88	26.47(1.75)	0.00[c***]
Reading	Baseline	2.93±1.03	0.93	0.00[a***]	2.93±0.80	0.80	0.02[a*]
	4th session	2.00±0.85	1.33	0.00[b***]	2.13±0.99	1.07	0.00[b***]
	8th session	0.67±0.62	43.96(1.7)	0.00[c***]	1.07±0.70	31.51(1.94)	0.00[c***]
Headache	Baseline	2.33±1.54	0.80	0.02[a*]	2.60±1.40	0.53	0.22[a]
	4th session	1.53±1.51	0.33	0.52[b]	2.07±1.03	0.33	0.41[b]
	8th session	1.20±1.15	9.40(1.68)	0.01[c*]	1.73±1.16	5.38(1.71)	0.04[c*]
Concentration	Baseline	2.40±0.91	0.60	0.10[a]	2.60±1.06	0.73	0.00[a***]
	4th session	1.80±0.77	1.20	0.00[b***]	1.87±0.83	0.67	0.01[b*]
	8th session	0.60±0.74	24.96(1.8)	0.00[c***]	1.20±0.87	23.89(1.79)	0.00[c***]
Work	0 session	2.87±0.92	1.13	0.00[a***]	2.67±1.05	0.87	0.00[a***]
	4th session	1.73±1.03	0.80	0.01[b*]	1.80±1.08	0.47	0.01[b*]
	8th session	0.93±0.96	38.3(1.84)	0.00[c***]	1.33±0.82	27.73(1.72)	0.00[c***]
Driving	Baseline	3.40±1.18	1.07	0.00[a***]	2.60±1.12	0.60	0.00[a***]
	4th session	2.33±0.90	0.93	0.00[b***]	2.00±1.31	0.47	0.04[b*]
	8th session	1.40±0.83	31.65(1.58)	0.00[c***]	1.53±1.19	25.25(1.89)	0.00[c***]
Sleeping	Baseline	2.60±0.74	0.467	0.09[a]	2.73±0.96	0.60	0.04[a*]
	4th session	2.13±0.99	1.27	0.00[b***]	2.13±0.83	0.47	0.21[b]
	8 session	0.87±0.92	30.167(1.83)	0.00[c***]	1.67±0.98	9.42(1.79)	0.01[c*]
Recreation	Baseline	3.00±0.93	1.27	0.00[a***]	3.13±0.74	1.07	0.00[a***]
	4th session	1.73±0.88	0.93	0.00[b***]	2.07±0.80	0.53	0.08[b]
	8th session	0.80±0.77	68.99(1.97)	0.00[c***]	1.53±1.13	24.41(1.52)	0.00[c***]
NDI Total score	Baseline	28.66±5.67	9.80	0.00[a***]	28.93±5.48	7.53	0.00[a***]
	4th session	18.87±4.78	10.06	0.00[b***]	21.40±4.64	6.07	0.00[b***]
	8th session	8.80±2.78	228.10(1.52)	0.00[c***]	15.33±3.90	153.0(1.54)	0.00[c***]

[a] Baselines to 4th session, [b] 4th session to 8th session, [c] Baseline to 8th session
*Level of significance: p<0.001***, p<0.0.1**, p<0.05**
MD: Mean Difference

After two weeks intervention, at the end of 8th session the experimental group showed more significant improvement (p<0.05) in pain on NPRS (0.87±1.19 ver. 3.20±1.61, p<0.001) and domains of NDI including pain intensity (0.53±0.64 ver. 1.67±0.82, p=0.03), personal care (0.60±0.74 ver. 1.67±0.82, p<0.001), lifting ability (1.20±1.21 ver. 2.07±0.88, p=0.03), sleeping (0.87±0.92 ver. 1.67±0.98, p=0.03) and total score NDI (8.80±2.78 ver. 15.33±3.90, p<0.001) was significantly improved in experimental group as compared to control group. While no significant difference between group was observed regarding reading (p=0.11), headache (p=0.22), concentration (p=0.05), work (p=0.23), driving (p=0.72), and recreation (p=0.05) after two weeks of intervention (Table 3)

DISCUSSION

This study determined the comparative effectiveness of strengthening exercises when combined with STM and when strengthening exercises are used alone for the management of TNS in females. According to the results of this study, neck isometric strengthening exercises in combination with STM as well as exercises alone were effective for managing neck pain and functional disability when a comparison was made within the groups. The participants in both the groups showed significant reduction in the pain intensity and improvement in their personal care activities, lifting activities, reading, work, and driving during and post-intervention. This might be because STM helps in reducing the pain intensity and increasing functional ability,[26] and exercises play an important role in the prevention of recurrent episodes of pain and the rehabilitation of impaired structures and physiological functions[4]. However, a few components of NDI, including headache, concentration, sleeping, and recreation

showed insignificant differences between some scores in the experimental and control groups. This might be attributed to some unidentified factors and small sample size which should be determined and addressed in the future studies.

Table 2: Between the Group Comparison of NPRS and NDI

NDI Items	No. of Sessions	Experimental Group Mean ± Std	Control Group Mean ± Std.	MD	p-value
NPRS	Baseline	7.20+ 1.32	7.47+1.64	-0.27	0.63
	4th session	3.80+1.70	5.13+1.30	-1.33	0.02*
	8th session	0.87+1.19	3.20+1.61	-2.33	0.00***
Pain intensity	Baseline	3.20±0.77	3.33±0.82	-0.13	0.65
	4th session	1.80±0.68	2.53±0.10	-0.73	0.03*
	8th session	0.53±0.64	1.67±0.82	-.1.13	0.00***
Personal care	Baseline	2.53±1.06	2.80±0.68	-0.27	0.42
	4th session	1.40±0.99	2.13±0.64	-.073	0.02*
	8th session	0.60±0.74	1.53±0.74	-0.93	0.00***
Lifting	Baseline	3.27±0.88	3.53±0.74	-0.27	0.38
	4th session	2.47±0.99	2.80±0.68	-0.73	0.29
	8th session	1.20±1.21	2.07±0.88	-0.93	0.03*
Reading	Baseline	2.93±1.03	2.93±0.80	0.00	1.00
	4th session	2.00±0.85	2.13±0.99	-0.13	0.70
	8th session	0.67±0.62	1.07±0.70	-0.40	0.11
Headache	Baseline	2.33±1.54	2.60±1.40	-0.27	0.62
	4th session	1.53±1.51	2.07±1.03	-0.53	0.27
	8th session	1.20±1.15	1.73±1.16	-0.53	0.22
Concentration	Baseline	2.40±0.91	2.60±1.06	-0.20	0.58
	4th session	1.80±0.77	1.87±0.83	-0.07	0.82
	8th session	0.60±0.74	1.20±0.87	-0.60	0.05
Work	Baseline	2.87±0.92	2.67±1.05	-0.20	0.58
	4th session	1.73±1.03	1.80±1.08	-0.07	0.86
	8th session	0.93±0.96	1.33±0.82	-0.40	0.23
Driving	Baseline	3.40±1.18	2.60±1.12	0.20	0.07
	4th session	2.33±0.90	2.00±1.31	0.13	0.42
	8th session	1.40±0.83	1.53±1.19	0.40	0.72
Sleeping	Baseline	2.60±0.74	2.73±0.96	-0.13	0.67
	4th session	2.13±0.99	2.13±0.83	-0.00	1.00
	8th session	0.87±0.92	1.67±0.98	-0.80	0.03*
Recreation	Baseline	3.00±0.93	3.13±0.74	-0.13	0.67
	4th session	1.73±0.88	2.07±0.80	-0.33	0.29
	8th session	0.80±0.77	1.53±1.13	-0.73	0.05
NDI Total score	Baseline	28.66±5.67	28.93±5.48	-0.27	0.90
	4thsession	18.87±4.78	21.40±4.64	-2.53	0.15
	8thsession	8.80±2.78	15.33±3.90	-6.53	0.00***

*Level of significance: p<0.001***, p<0.0.1**, p<0.05**

Between the groups comparison showed that the NPRS scores during and post-intervention, and at the baseline and post-intervention showed more reduction in the experimental group as compared to the control group. Furthermore, the total NDI scores at the baseline and post-intervention showed more reduction in the experimental group as compared to the control group. This might be because a combination of both interventions would have helped in reducing the alteration in the neuromuscular and sensorimotor system due to chronic neck pain which causes functional disability[4].

In a study conducted in the past, massage therapy was determined to be more effective than exercises for pain relief[27]. Though the findings of this study are like those of the current study, however instrumental STM instead of manual STM was used in the previous study, and the effects of exercises and STM combined were not seen. Similarly, another study has reported considerable improvement in patients who received STM, in terms of pain intensity; however, the comparison was made with therapeutic ultrasound[28].

While manual therapy techniques such as STM allow therapists to identify and treat soft tissue dysfunctions, therapeutic exercises increase muscle and ligament strength, improve the mobility of structures, and prevent tendon injuries. It may be that both treatments combined would have helped in the myofascial release, which would have formed the basis for the realignment of the impaired structures and creating appropriate postural adjustments, [29] thus more improvement in the experimental group as compared to the control group in the current study.

In a systematic review conducted by Hidalgo, Banjamin et al., on the efficacy of manual therapy and exercise for treating non-specific neck pain, it was concluded that combining different forms of manual therapy with exercise is better than manual therapy or exercise alone[30].The results of this study are like the current study except that in the current study the effects of manual therapy alone were not determined.

Furthermore, there are certain factors that have shown to be associated with the higher prevalence of pain in females as compared to males in the previous studies, including a higher prevalence of psychological issues such as anxiety and depression, lower muscular strength, and pain threshold, as well as poor sleep quality[17]. This provides important evidence for the clinicians in determining the causes of NP typically associated with the female gender.

The limitations of the study are that it was conducted for short time duration, on a small sample size, and the female participants who belonged to a broad age range.

CONCLUSION

Neck isometric strengthening exercises when combined with soft tissue mobilization were more effective than neck isometric exercises alone for reducing the pain intensity and disability in females with tension neck syndrome. Future studies should be conducted for a longer duration to see the long-term retention effects of the combined therapy approach, and gender-based study with larger sample size and a more specific age range to draw more generalized conclusions.

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