Research Paper

Effects of Kendall Exercise vs. Gong's Mobilization on Pain, Range of Motion, Function, and Strength in Cases With Text Neck Syndrome

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ABSTRACT

Objectives: To determine the impact of Kendall versus Gong's intervention according to pain sensation, range of movement, function, strength, and posture in cases with text neck syndrome.

Methods: This randomized clinical trial recruited a sample of 24 patients with text neck syndrome from Fatima Hospital, Sargodha, Pakistan from January to April 2021. The samples were randomly divided into 2 groups using the envelope method. Group A received Kendall's intervention while group B received Gong's mobilization. The intervention was performed in 18 sessions for each patient during 6 weeks i.e. 3 per week. Neck disability index, numeric pain rating scale, cervical range of motion (ROM), cranio-vertebral angle (CVA), rounded shoulder angle (RSA), and modified sphygmomanometer test were used to collect data. All outcomes were measured at baseline and six weeks after intervention and analyzed using SPSS software, version 23. T-test was used to analyze within and between-group differences, and $P<0.05$ was considered significant.

Results: A significant difference with $P<0.05$ was observed for within and between group statistics. Gong's mobilization showed more effectiveness ($P<0.001$) for all output measures depending on differences between mean scores.

Discussion: The study concluded that both Kendall's exercise and Gong's mobilization were useful in the reduction of pain and functional disability; improvement in cervical range and strength of cervical muscles. However, Gong's mobilization was superior to Kendall's exercise in improving text neck syndrome for outcome measures, including neck pain, disability, craniovertebral angle, rounded shoulder angle, cervical range of motion (ROM), and cervical muscle strength.

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Highlights

• Both Kendall's exercise and Gong's mobilization reveal a significant improvement in terms of numeric pain rating scale (NPRS), neck disability index (NDI), cranio-vertebral angle (CVA), rounded shoulder angle (RSA), cervical range of motion (ROM), and cervical muscle strength.

• Gong's mobilization reveals significant improvement compared to Kendall's mobilization for NPRS, NDI, CVA, and RSA.

• Gong's mobilization reveals significantly more improvement compared to Kendall's mobilization for cervical ROM for extension, right and left side bending, and right and left rotation with no significant difference for flexion.

• Gong's mobilization reveals significantly more improvement compared to Kendall's mobilization for Isometric cervical muscle strength for all movements.

Plain Language Summary

The text neck syndrome has a high prevalence affecting millions of people worldwide. With the knowledge gap related to treatment strategies, the current randomized clinical trial with 24 patients with text neck syndrome explored the impact of Kendall and Gong's intervention for function, pain, range of motion (ROM), strength, and posture and noted a significant difference with $P<0.05$ in terms of within and between group statistics. Gong's mobilization showed more effectiveness ($P<0.001$) for all output measures depending on the difference in mean scores; hence Gong's mobilization is more effective.

Introduction

The term "text neck" is the brainchild of Dr. Dean and represents an overuse syndrome resulting from a head posture adopted during mobile phone usage with downward and forward flexion [1]. It results in harmful symptoms in areas of the head, neck, shoulder, and upper back. While focusing on the screens of smartphones, as the neck flexion angle increases, the forces on the neck increase proportionately [2].

This postural problem is becoming a major health concern and can affect millions of people worldwide. A study conducted by Kumari et al. reported a high prevalence of text neck syndrome with a mild prevalence of 36%, moderate 23.4%, and severe and complete text neck syndrome of 2.1% [3]. A local study also revealed the alarming nature of the condition with most population suffering neck pain using mobiles for more than 3 hours a day with a neck angle of 30-45 degrees [4]. Clinically text neck can present with neck stiffness, pain that is cutting and radiating, and general features, such as the area being sore, numb, and weak as well as headache [5]. Bad posture related to prolonged musculoskeletal aches includes head bending forwards [6]. Literature reveals that the young adult population lacks awareness as well as knowledge of prevention regarding this condition [7] with treatment strategies being a topic requiring further research [8].

The results of a study conducted by Kong et al. suggest that the Mackenzie and Kendall program is very useful to cater to disabling conditions, neck range of motion (ROM), pain, and improved forward head posture due to mobile usage [9], while Gong et al. reported that Gong mobilization used to increase the ROM is better than glides [10]. Hence, the literature supports the effectiveness of Kendall and Gong's intervention in reducing pain, and disability and improving cervical ROM in separate studies. However, very limited studies have been conducted regarding the use of Gong's intervention in the neck region. Moreover, the combined impact of Kendall versus Gong's intervention has not been investigated in text neck syndrome. Therefore, the present study undertook to determine the impact of these treatments on pain, movement range, function, strength, and posture in cases suffering from the syndrome of text neck. This area of study is crucial since it involves a huge segment of society and helps clinicians to better decide treatment strategies for cases with text neck syndrome along with future research purposes.

Materials and Methods

This clinical trial was conducted randomly in the physiotherapy department of Fatima Hospital, Sargodha. The study was conducted over 4 months from January 1 and April 30, 2021. The study recruited 24 young adults of both genders aged 18-35 years who were using smartphone for >2 hours per day. Randomization was performed using the sealed envelope method and was equally divided into groups A and B. The inclusion criteria included cases with neck pain aggravated by sustained posture, stiffness on neck and neck turning, the Craniovertebral angle (CVA) <50°, rounded shoulder angle (RSA) >52°, numeric pain rating scale (NPRS) >5 and neck disability index (NDI) of >10. The exclusion criteria included cases with spinal infective and inflammatory conditions, cervical surgery or traumatic injury, tumors, torticollis, and scoliosis, pregnant ladies; patients having prolapse of the disc, and other spine issues, such as stenotic, herniated discs, spondylolisthesis and cases with osteoporotic bones, and those currently using any medication or taking physical therapy sessions.

Utilizing a G-Power 2-tailed test with an alpha value of 0.05, the effect size of 0.6, a non-centrality parameter of 2.94, criticality of 2.06, df of 23, power of 0.80, and effect size of 0.6, a sample size of 24 was calculated. For this issue, 34 cases were assessed for eligibility (Figure 1), of which 10 cases were excluded, 10 cases did not meet selection criteria and 2 declined to consent to participate.

The outcome measures studied included pain, function disability, cervical ROM, cervical muscle strength, CVA, and RSA. The tools employed included reliable and valid measures, including NPRS [11] for pain assessment, NDI [12] for functional disability, universal goniometer (UG) [13] for measuring measure active cervical ROM, and modified Sphygmomanometer test [14] for the strength of cervical muscles and posture was analyzed by photography [15].

The NPRS [11] is a reliable and valid measure to assess the level of pain and patients rank it on a scale of 0 to 10 with 0 for no pain and 10 for the worst level of pain. Secrecy of the patient's score was maintained. The NDI [12] has good validity and reliability and hence used for measuring functional disability. NDI has 10 sections and is scored 0 to 50, with a higher score indicating greater impairment. Each item is scored from zero for no disability to 05 for complete disability and a score of 50 represents the maximum score. UG was used to measure

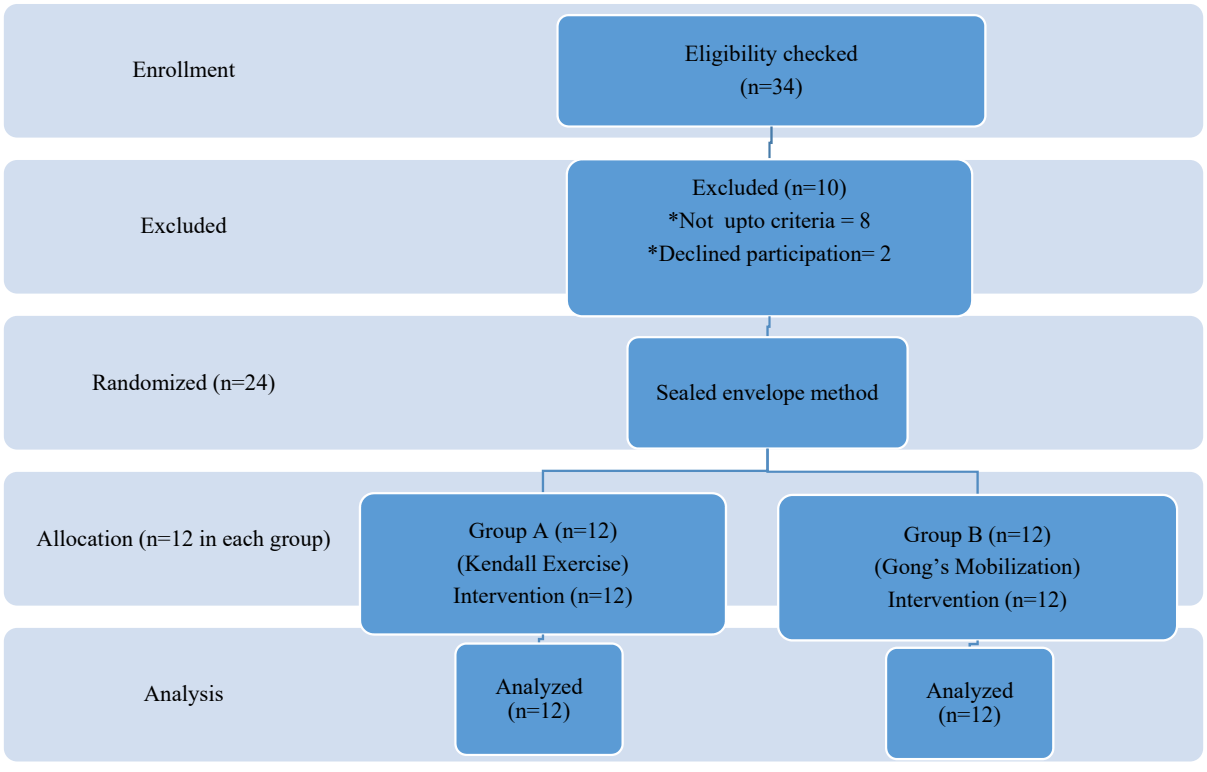

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Figure 1. Data collection protocol followed: Consort diagram

active cervical ROM since UG is an affordable, simple, and common tool with outstanding inter and intra-rater validity for measurement [13]. The modified sphygmomanometer test [14, 16] was used to record the power of neck flexors, extensors, side-flexor and rotator musculature. Photogrammetry [17] was used for postural evaluation. Forward head postures were measured by measuring CVA and RSA. For this photos were taken from the patient's right side and analyzed using Image J Software [15]. For video recording, a Sony 16.1 M pixels device was used with a tripod at a distance of 0.8 m from the patient at a height that matched with C7 vertebra. The site of the C7 vertebral process and acromion were marked to confirm the exact position and stability of the bony landmark. Participants were asked to stand in front of the wall while the examiner took a photo. The photo was transferred into a computer, and CVA and RSA were measured using Image J software [15].

Group A received Kendall's exercises while group B performed Gong's mobilization.

The intervention of group A included the application of hot packs on the upper back and neck for 7 to 10 minutes followed by maneuvers, including positioning supine with the chin tucked in and lifting the head for 2 to 8 s to strengthen deep cervical flexors, maintaining a sitting posture, with hands on the occipital region, and flexed spine while moving head downwards to stretch cervical extensors, maintaining an upright posture, keep the resistance band circling with strong support and stretching it with the upper limbs of both sides so that there is full retraction of the scapula to strengthen retractors of the shoulder, and stretching the pectoralis major and minor while keeping the patient's hands-on the occipital region and standing behind the patient and pulling both elbows backward to target the bilateral pectoralis muscles. Each posture was maintained for 30 s and 5 sets of 12 repetitions were performed with 3 sessions per week on alternate days [18].

The intervention for group B included the application of hot packs on the upper back and neck for 7 to 10 minutes. The patient was given sustained glide along the facet joint and simultaneously the physiological movement to the end range in such a way that the patient's neck posture remained neutral passively to induce normal cervical motion [10]. Flexion, side bending, and rotation of the patient were performed; 10-15 repetitions, 3 sessions every week on alternate days for 6 weeks. The intervention lasted 20-30 minutes in each session and evaluation was performed pre-treatment and post-treatment in the sixth week and a total of 18 sessions were performed for each patient. The parameters recorded included NPRS, NDI, cervical ROMs, isometric neck strength, CVA, and RSA.

SPSS software, version 23 was used for data analysis. The paired t-test was used for between-group analyses, while an independent t-test was conducted for within-group analysis, and $P<0.05$ was considered significant.

Results

For 24 participants included in the study, no significant difference ($P=0.93$) was observed among the groups in terms of age with the mean in Kendall's exercise group being 26.17±4.34 years, and in Gong's mobilization group, it was 26.33±4.85 years. Similarly, gender revealed no significant difference between the groups ($P=0.673$) with 8 women (66.67%) and 4 men (33.33%) in the Kendall group and 7 women (29.17%) and 5 men (20.83%) in Gong's mobilization group (Table 1). A significant improvement ($P<0.001$) was observed in within-group statistics for all the output measures during

Table 1. Characteristics of participants (n=24)

Variables		No. (%)/Mean±SD		P
		Intervention Group		
		Kendall	Gong	
Sample		12(50.0)	12(50.0)	-
Gender	Male: 9(37.5)	4(16.67)	5(20.83)	0.673
	Female: 15(62.5)	8(33.33)	7(29.17)	
Age (y)		26.17±4.34	26.33±4.85	0.930

4 weeks for both Kendall's exercise and Gong's mobilization group.

While in the between-group analysis, a significant difference was observed for NPRS (P<0.001), NDI (P=0.016) with lower mean scores for Gong's mobilization; CVA (P=0.009) with a higher mean for Gong's mobilization and RSA (P=0.024) with a higher mean for Kendall's exercise (Table 2). With a higher mean for Gong's mobilization cervical ROM revealed a significant difference for extension (P=0.019), right-side bending (P=0.027), left-side bending (P=0.037), right rotation (P=0.048) and left rotation (P=0.019). However, the difference for flexion was not significant (P=0.052) (Table 3). Also, with higher scores for Gong's mobilization, Isometric cervical muscle strength revealed a significant difference for flexion (P=0.007), extension (P=0.037), right-sided bending (P=0.044), left-sided bending (P=0.026), right rotation (P=0.031) and left rotation (P=0.040) (Table 4).

Discussion

The current study analyzed the impact of Kendall and Gong's intervention to enhance scores for NPRS, NDI, ROM of neck, neck posture, and muscular strength in cases with text neck. The results revealed a significant improvement for both groups receiving intervention regarding all output measures.

Gong's mobilization demonstrated significantly reduced pain, and improved function, ROM, cervical strength, and posture with P<0.05. Similarly, a study conducted by Harsulkar et al. reported positive results for Gong's mobilization in terms of pain, ROM, and posture [19].

Kendall's exercise is used to reduce the pain and improve posture and alignment. According to the current study, Kendall's exercise is also effective in reducing pain. This is consistent with Kim's research, which concluded that the use of Kendall's exercise, sling, and horseback riding simulator can reduce pain score and improve posture score in patients with forward head posture [20]. In contrast, Kim et al. reported that horse riding stimulator exercise was found to be more beneficial than Kendall's exercise in decreasing pain and improving posture [18].

Individuals with minor CVA have increased forward head posture and disability [21]. In the current study, the participants of both groups revealed a significant improvement in CVA after receiving their respective interventions with significantly more improvement in Gong's mobilization group, indicating the usefulness of

Table 2. Comparison of output variables among the groups (n=24)

Variables	Intervention	Mean±SD		P
		Pre-intervention	Post-intervention	
Numeric pain rating scale	Kendall	6.91±1.37	3.16±0.83	<0.001
	Gong's	6.91±0.99	1.5±0.79	<0.001
	P	1.00	<0.001	
Neck disability index	Kendall	23.08±6.05	15.0±5.34	<0.001
	Gong's	22.83±4.62	10.58±1.44	<0.001
	P	0.911	0.016	
Cranio-vertebral angle	Kendall	43.13±4.32	50.58±6.91	0.003
	Gong's	44.62±4.19	57.08±3.08	<0.001
	P	0.399	0.009	
Rounded shoulder angle	Kendall	63.16±7.34	50.31±8.66	0.001
	Gong's	61.90±5.31	43.18±4.98	<0.001
	P	0.635	0.024	

Table 3. Within and between goups comparison of cervical ROM (n=24)

Variables	Intervention	Mean±SD		P
		Pre-intervention	Post-intervention	
Flexion	Kendall	33.25±7.02	49.0±5.79	<0.001
	Gong's	31.08±8.061	54.08±6.31	<0.001
	P	0.490	0.052	
Extension	Kendall	30.5±7.29	47.5±6.2	<0.001
	Gong's	27.65±5.83	53.16±4.60	<0.001
	P	0.305	0.019	
Right side bending	Kendall	28.08±2.9	46.08±2.31	<0.001
	Gong's	24.91±7.47	48.75±3.13	<0.001
	P	0.193	0.027	
Left side bending	Kendall	28.58±4.20	48.08±3.89	<0.001
	Gong's	28.08±3.08	50.83±1.80	<0.001
	P	0.743	0.037	
Right rotation	Kendall	44.5±4.85	58.16±4.87	<0.001
	Gong's	41.75±4.53	61.66±3.14	<0.001
	P	0.166	0.048	
Left rotation	Kendall	40.66±7.26	54.25±2.59	<0.001
	Gong's	41.5±5.55	57.16±3.01	<0.001
	P	0.755	0.019	

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both techniques in correcting posture [22]. Gong's mobilization results are significantly better than sustained natural apophyseal glides (SNAGS) reported in a study conducted by Gong et al. [23].

In the current study with improved cervical muscle strength, shoulder angle decreased following both interventions with a significantly greater reduction in angle and increased strength in Gong's mobilization group. Consistent with our study and in a previous study, Gong's mobilization revealed improved medical rotation of the shoulder compared to Mulligan's mobilization [24]. Also, Gong et al. concluded that Gong's mobilization was beneficial in the clinical setting because it can have an immediate effect and it is possible to do it while the patient is sitting [25].

Mobilization of soft tissue improves neck pain as well as ROM up to a limit but does not relieve disability when compared to stretching exercises [26]. The results of the present study indicated a significant improvement in both groups receiving intervention regarding all outcome measures. However, the mean change in values of Gong's intervention group revealed more improvement compared to Kendall's exercise group. Shrestha and Joshi in their study on frozen shoulder patients reported a significant improvement in pain, ROM, and disability using Gong's mobilization [27]. Similarly, in a study comparing the effect of Gong's mobilization and SNAG for low back pain, Gong et al. reported a significant improvement in lumber extension ROM in Gong's mobilization group compared to SNAG [28]. Another study in 2015 on the effects of Gong's intervention and SNAGs on Cx spondylosis stated Gong's intervention is useful for cervical spondylosis to decrease pain and improve

Table 4. Within and between group comparison of isometric cervical muscle strength (n=24)

Variables	Intervention	Mean±SD		P
		Pre-treatment	Post-treatment	
Flexion	Kendall	32.83±4.56	50.41±5.68	<0.001
	Gong's	34.75±5.44	59.0±8.146	<0.001
	P	0.360	0.007	
Extension	Kendall	32.33±7.52	49.83±4.48	<0.001
	Gong's	33.50±4.79	54.5±5.71	<0.001
	P	0.655	0.037	
Right side bending	Kendall	36.08±8.70	54.16±3.71	<0.001
	Gong's	35.91±9.30	58.25±5.46	<0.001
	P	0.964	0.044	
Left side bending	Kendall	37.41±6.34	53.41±5.36	<0.001
	Gong's	35.25±6.25	58.166±4.34	<0.001
	P	0.409	0.026	
Right rotation	Kendall	31.75±5.10	51.0±4.51	<0.001
	Gong's	34.41±5.48	54.75±3.36	<0.001
	P	0.230	0.031	
Left rotation	Kendall	35.66±7.12	54.0±4.41	<0.001
	Gong's	38.83±7.32	57.75±4.00	<0.001
	P	0.295	0.040	

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cervical ROM [19]. Similarly, GoPinath et al. reported a significant reduction in pain and functional disability as well as improved ROM in cases with grade 2 of frozen shoulder compared to the muscle energy technique [29]. Also, Gong's mobilization has been reported to be more beneficial than Scapular as well as Gleno-humeral mobilization to improve pain, ROM, and disability in cases with shoulder joint peri-arthritis [30]. In a study conducted by Sah et al. Gong's and Cyriax manipulations were equally effective and improved shoulder abduction and functional loss in cases with frozen shoulders [31]. Ramteke and Nagulkar in their study reported that Gong's mobilization with conventional therapy was more effective than conventional therapy alone with significantly improved pain and ROM for frozen shoulder cases [32].

Conclusion

The study concluded that both Kendall's exercise and Gong's mobilization were useful in reducing pain and limiting functional disability, enhancing cervical ROM and cervical muscle strength. However, Gong's mobilization was more efficacious than Kendall's exercise in bringing relief for cases with text neck in terms of outcome measures, including neck pain, disability, cranio-vertebral angle, rounded shoulder angle, cervical ROM, and isometric cervical muscle strength.

Strengths and limitations of study

The study addresses a crucial clinical issue but has limitations since long-term consequences were not studied. The reliability of the placement of markers was not tested following manual placement. Also, chronicity was not considered while categorizing the effects.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Riphah International University (Code: REC/RCR&AHS/20/0105) and was registered at the Iranian Registry of Clinical Trials (No: IRCT20201019049069N1). Informed consent of participants for inclusion in the study.

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Authors' contributions

Conceptualization and supervision: Rabiya Noor, Nazia Mumtaz; Methodology, resources, and data curation: Hamna Afzal, Rabiya Noor; Formal analysis and writing-original draft preparation: Muhammad Salman Bashir and Nazia Mumtaz; Writing-review and editing: Ghulam Saqulain and Rabiya Noor.

Conflict of interest

The authors declared no conflict of interest.

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