

COMPARISON OF MCKENZIE EXERCISES VERSUS COMBINED MCKENZIE AND BRUGGER RELIEF EXERCISES IN INDIVIDUALS WITH TEXT NECK SYNDROME: A RANDOMIZED CONTROLLED TRIAL

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Abstract

Background: Text Neck Syndrome is a rising musculoskeletal condition related to excessive use of smartphones, tablets, and other digital devices, accompanied by prolonged forward head posture and continuous cervical flexion.

Objective: To evaluate and compare the effects of mckenzie exercises and combined mckenzie and brugger Relief Exercises in Individuals with Text Neck Syndrome.

Methodology: Participants were divided into two groups: one receiving McKenzie exercises and the other McKenzie exercises with Brugger's relief exercises. Results were assessed over a 6-week period, aiming on pain levels and functional ability with the help of goniometer, Numeric pain rating scale (NPRS), Neck Disability Index (NDI) scores. Data was analyzed using SPSS-27.

Results: Mean comparison of NPRS, NDI, and CAROM between the Combined McKenzie and Brugger Relief Exercises Group and the McKenzie Exercises Group. In the Combined group, NPRS reduced from 7.86 ± 1.149 to 2.48 ± 1.422 , while NDI reduced from 78.06 ± 8.66 to 20.89 ± 5.60 ($p < 0.05$). CAROM also improved, with cervical extension increasing from $28.33 \pm 7.82^\circ$ to $46.17 \pm 3.50^\circ$ and cervical rotation from $36.56 \pm 15.78^\circ$ to $72.67 \pm 5.20^\circ$. In the McKenzie group, NPRS decreased from 7.01 ± 1.270 to 5.05 ± 1.376 , and NDI decreased from 66.72 ± 13.47 to 42.89 ± 8.51 . Cervical flexion increased from $33.78 \pm 4.66^\circ$ to $38.28 \pm 5.03^\circ$, while cervical rotation increased from $49.78 \pm 8.08^\circ$ to $59.56 \pm 3.80^\circ$.

Conclusion: Overall, both groups showed marked improvement ($p < 0.05$), but the Combined McKenzie and Brugger Relief Exercises Group showed greater improvement in pain, disability, and cervical ROM.

INTRODUCTION

Text Neck Syndrome is an rising musculoskeletal condition related to the excessive use of smartphones, tablets and other digital devices, accompanied by prolonged forward head posture and continuous cervical flexion. In recent years, rapid technological advancement has markedly changed lifestyle behaviors, leading to increased screen time among all age groups. (1) Globally, studies report that the prevalence of neck pain related to poor posture and device use ranges widely from 16.7% to 75.1%, showing a significant burden of musculoskeletal disorders in the general population. (2) Among young adults and students, the prevalence is even higher due to excessive screen time. A 2025 study found that 100% of participants showed some level of Text Neck symptoms, with 45% having mild, 36% moderate, and 19% severe forms, highlighting the vast nature of the condition in this age group. (3)

At the local level, particularly in Pakistan, the frequency is alarmingly high among university students. A study organised in Karachi reported that 66.49% of physiotherapy students showed text neck posture, strongly related to smartphone addiction, where 86.5% of participants were classified as addicted to smartphone use. Similarly, studies in Lahore and Khyber Pakhtunkhwa have documented a high frequency of Text Neck Syndrome among undergraduate students who use mobile devices for more than one hour daily, highlighting the growing burden in the younger population. (4) This increasing frequency highlights the urgent need for preventive strategies and effective therapeutic interventions to manage this condition. (5) The underlying mechanism of Text Neck Syndrome primarily includes continuous cervical flexion and forward head posture. When the head bends forward, the mechanical load on the cervical spine increases exponentially. (6) Neurological symptoms such as tingling, numbness, and radiating pain may occur due to compression of cervical nerve roots. If left untreated, these pathological changes may lead to chronic pain and long-term disability. (7)

The etiology of Text Neck Syndrome is complex, involving behavioral, ergonomic, and physiological factors. The primary cause is prolonged use of handheld devices in a flexed neck posture, often associated with poor sitting habits and insufficient ergonomic awareness. (8) Addressing these factors can significantly reduce the incidence and severity of symptoms. (9) Highlights patient self-management and active participation, making it more effective for long-term results. (10) Brugger relief exercises, on the other hand, aims on postural correction and muscle activation. The protocol includes adopting the relief position characterized by an upright sitting posture with chest expansion, scapular retraction, external rotation of shoulders, and slight chin tuck. This position is held for short durations and repeated often throughout the day. Additional exercises include scapular stabilization, thoracic extension movements, and dynamic arm movements to improve coordination and muscle balance. (11) Exercise-based interventions, specifically McKenzie and Brugger relief exercises, play an important role in addressing this condition. This study focuses to compare the effectiveness of McKenzie exercises versus combined McKenzie and Brugger relief exercises in individuals with Text Neck Syndrome, providing marked insights for evidence-based physiotherapy practice. (13) Text neck syndrome is operationally defined as neck pain and postural dysfunction resulting from prolonged smartphone use, characterized by forward head posture, reduced cervical range of motion, and discomfort lasting for at least 3 months. (14)(15) It was identified using a Neck Disability Index (NDI) score ≥ 10 and controlled observation of forward head posture. (17) Brugger's relief exercises are defined as postural correction exercises involving spinal extension, scapular retraction, shoulder external rotation, and deep breathing, aimed at reversing flexion posture. (18)

METHODOLOGY

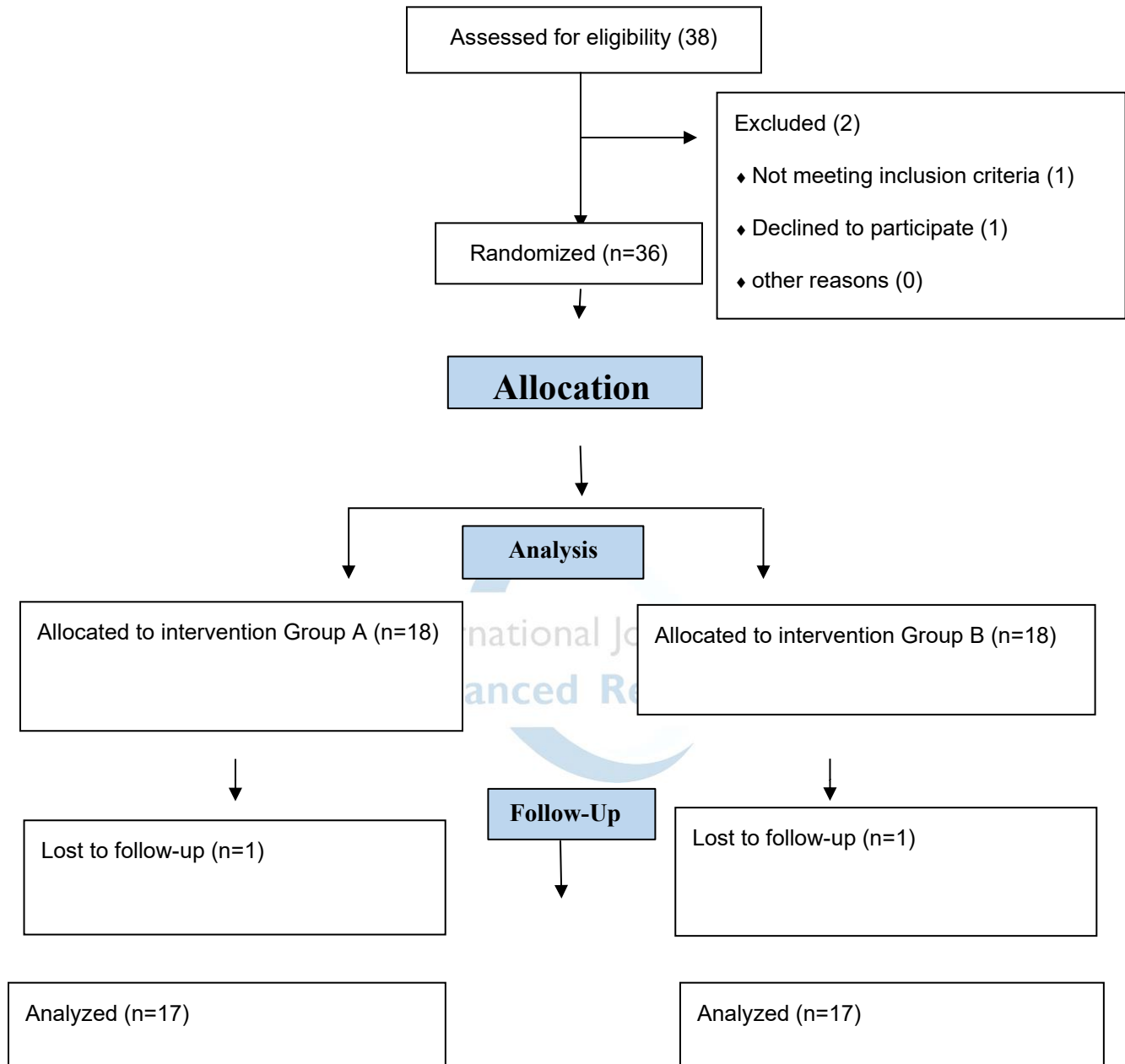
The design of this study was Randomized controlled Trial (RCT). Data was collected from

Physiotherapy department of Al shifa ultrasound and family clinic ,Lahore. A total of 34 patients were screened according to inclusion criteria. After the data collection, the data was analyzed through SPSS-27. Non probability purposive sampling technique was used. Based on these calculations, the calculated total sample size to detect statistically significant differences was 34 participants.(19) The duration of this study was 10 months.Participants who meet inclusion criteria shall choose via lottery method and assigned into one of two groups A or B. This was Single blinded , Outcome assessors was recruited and also blinded to the treatment group allocation. **Inclusion criteria meets** Individuals aged 18–35 years, as this age group represents the highest smartphone usage population and is more prone to text neck syndrome.(1) Both male and female participants was included. Participants must controlledly present with text neck syndrome, confirmed through orthopedic physician and the following diagnostic criteria: (History of prolonged smartphone use ≥ 3 –4 hours per day for at least 3 months)(2) Forward Head Posture (FHP) identified by reduced craniovertebral angle ($<50^\circ$)(20) Pain intensity ≥ 3 on Visual Analog Scale (VAS)(20).Neck Disability Index (NDI) score between 10–30 (mild to moderate disability)(21) Reduced cervical range of motion (especially flexion and/or extension)(21) and Positive findings on deep neck flexor endurance test Craniocervical Flexion Test (reduced holding time compared to normal values)(21)

Exclusion Criteria excludes: Cervical disc prolapse with neurological deficit ,Cervical radiculopathy or myelopathy(7) History of cervical spine fracture, tumor, or infection or Cervical Spine Surgery(8) Group A was treated with McKenzie exercises for 30 minutes for 3 sessions per week for 6 weeks (18 sessions total). Therapist will stand beside the patient. In Group A, participants will perform McKenzie cervical exercises focusing on repeated movements and postural correction. The exercise protocol will include cervical retraction (chin tuck in sitting),

cervical extension in sitting, and cervical extension in prone lying. Each exercise was performed for 10 repetitions per set, with a total of 3 sets per exercise in each session. The end position of each movement was held for 5–7 seconds, ensuring that all exercises are performed within a pain-free or tolerable range. Rest intervals of 10–15 seconds was provided between repetitions and 1–2 minutes between sets to prevent fatigue.(1) Group B was treated with McKenzie exercises along with Brugger's relief exercises for 30 minutes for 3 sessions per week for 6 weeks (18 session total). Therapist will stand beside the patient. In Group B, participants will receive a combined intervention consisting of McKenzie exercises along with Brugger's relief exercises. The McKenzie exercise protocol will remain the same as in Group A. In addition, Brugger's relief exercises was incorporated to improve postural alignment and muscular endurance. These exercises will include thoracic extension with chest expansion, scapular retraction and depression, shoulder external rotation with slight abduction, and deep breathing combined with postural correction. Each Brugger exercise was performed for 10–15 repetitions with 3 sets per session. The end position was held for 5–10 seconds with emphasis on controlled movement and correct posture. Rest intervals of 10–15 seconds between repetitions and 1–2 minutes between sets was provided. The total duration of each session in Group B was approximately 30–35 minutes due to the addition of Brugger's exercises.(22) The 10-point numeric scale ranges from '0' representing "no pain" to '10' representing "pain as bad as you can imagine" or "worst pain imaginable". The NPRS is a valid and reliable scale to measure pain intensity. (23) Goniometry is particularly used to measure joint range of motion, but may not capture other aspects of functional ability.0.98%(24) The NDI evaluated the impact of neck pain on daily activities such as personal care, lifting, reading, work, and concentration. A reduction in NDI score reflects improvement in functional ability, and a change of 8–10 points.

CONSORT DIAGRAM



RESULTS

Table 1: Baseline Demographic

Variable		N=34	Group A	Group B
Age (Years), Mean $\pm$ SD		31.56 $\pm$ 5.58	31.24 $\pm$ 5.12	31.88 $\pm$ 6.11
Gender	Male	44.1%	47.1%	41.2%
	Female	55.9%	52.9%	58.8%
Height (ft),		5.16 $\pm$ 0.61	5.18 $\pm$ 0.58	5.14 $\pm$ 0.65

Mean $\pm$ SD			
Weight (kg), Mean $\pm$ SD	89.75 $\pm$ 15.11	88.40 $\pm$ 14.80	91.10 $\pm$ 15.75
BMI (kg/m ²), Mean $\pm$ SD	38.57 $\pm$ 9.80	38.12 $\pm$ 9.45	39.02 $\pm$ 10.42

The study included 34 participants, with 17 participants in Group A (Combined McKenzie and Brugger relief exercises) and 17 participants in Group B (McKenzie exercises alone). The mean age of the total sample was 31.56 $\pm$ 5.58 years, with Group A having a mean age of 31.24 $\pm$ 5.12 years and Group B 31.88 $\pm$ 6.11 years.

Gender distribution with 47.1% males and 52.9% females in Group A and with 41.2% males and 58.8% females in Group B. Height (5.18 $\pm$ 0.58 ft vs. 5.14 $\pm$ 0.65 ft), weight (88.40 $\pm$ 14.80 kg vs. 91.10 $\pm$ 15.75 kg), BMI (38.12 $\pm$ 9.45 kg/m² vs. 39.02 $\pm$ 10.42 kg/m²).

Table 2: Shapiro-Wilk Normality Test

Shapiro-Wilk			
	Statistic	Df	P value
PRE_NPRS	.956	34	.165
PRE_NDI	.948	34	.094
PRE_CERVICAL_FLEX	.945	34	.073
PRE_CERVICAL_EXT	.959	34	.203
PRE_CERVICAL_ROTATION	.962	34	.253
PRE_CERVICAL_LATERAL_FLEX	.950	34	.102

Table shows the SW results to compare data distribution. For the pain measurements, all test statistics were non-significant ($p > 0.05$) showing that data distribution at each time point were normal. Shapiro Wilk shows P values greater

than 0.05 for NPRS, NDI and C-AROM, measurements data were non significance, ($p > 0.05$), all variables meet the normality assumption for using the parametric tests.

Table 3: Paired Samples t-test

Within-Group	Mean	Std. Deviation	Mean Difference	P-Value
PRE_NPRS	7.43	1.270	3.669	.000
POST_NPRS	3.77	1.898		
PRE_NDI	72.39	12.557	40.50	.000
POST_NDI	31.89	13.227		
PRE_CERVICAL_FLEX	29.97	6.157	14.917	.000
POST_CERVICAL_FLEX	44.89	8.782		
PRE_CERVICAL_EXT	30.81	7.317	11.528	.000
POST_CERVICAL_EXT	42.33	5.477		
PRE_CERVICAL_ROTATION	43.17	14.060	22.944	.000
POST_CERVICAL_ROTATION	66.11	8.028		

PRE_CERVICAL_LATERAL_FLEX	31.22	4.447	11.028	.000
POST_CERVICAL_LATERAL_FLEX	42.25	5.168		

This table shows mean comparison of NPRS, NDI and C-AROM before treatment and after treatment. The pre-treatment value of NPRS test was 7.43 ± 1.270 and post treatment was 3.77 ± 1.898 . mean difference was 3.669 ± 0.628 The pre-treatment value of NDI was 72.39 ± 12.557 and post treatment value was 31.89 ± 13.227 , mean differences was 40.50 ± 0.67 . The pre-treatment value of flexion was 29.97 ± 6.157 ,

extension was 30.81 ± 7.317 , rotation was 43.17 ± 14.060 , lateral flexion was 31.22 ± 4.447 and post treatment value is 44.89 ± 8.7 , 42.33 ± 5.477 , 42.25 ± 42.25 . mean differences is -14.917 ± -2.625 , -11.528 ± 1.84 , 66.11 ± 8.028 , -22.944 ± 6.032 , -11.028 ± 0.721 respectively. P-value is less than 0.05 that shows there is significant difference.

Table 4: Independent Samples t-test

Between-Group Comparisons		Mean	Std. Deviation	Mean Difference	P-Value
PRE_NPRS	A	7.86	1.149	.853	.042
	B	7.01	1.270		
POST_NPRS	A	2.48	1.422	-2.57	.000
	B	5.05	1.376		
PRE_NDI	A	78.06	8.660	11.3	.005
	B	66.72	13.477		
POST_NDI	A	20.89	5.603	22.0	.000
	B	42.89	8.519		
PRE_CERVICAL_FLEX	A	26.17	5.067	-7.61	.000
	B	33.78	4.660		
POST_CERVICAL_FLEX	A	51.50	6.392	13.2	.000
	B	38.28	5.039		
PRE_CERVICAL_EXTENSION	A	28.33	7.822	-4.94	.041
	B	33.28	6.008		
POST_CERVICAL_EXTENSION	A	46.17	3.502	7.66	.000
	B	38.50	4.287		
PRE_CERVICAL_ROTATION	A	36.56	15.782	13.2	.003
	B	49.78	8.085		
POST_CERVICAL_ROTATION	A	72.67	5.202	13.1	.000
	B	59.56	3.823		
PRE_CERVICAL_LATERAL_FLEX	A	29.50	3.130	3.4	.018
	B	32.94	4.964		
POST_CERVICAL_LATERAL_FLEX	A	45.28	4.738	6.05	.000
	B	39.22	3.623		

Table show mean comparison of NPRS, NDI and C-AROM for both groups. Combined McKenzie and Brugger relief exercises group the mean

NPRS before treatment was 7.86 ± 1.149 and after the treatment was 2.48 ± 1.422 . mean difference of NPRS of Combined McKenzie and

Brugger relief exercises group was .853 along with p-value less than 0.05. Mean of NDI before treatment was 78.06 ± 8.66 and after the treatment was 20.89 ± 5.60 . mean difference NDI of Combined McKenzie and Brugger relief exercises group was 11.33. with p value less than 0.05. Mean of C-AROM before treatment was (cervical flexion) 126.17 ± 5.067 after the treatment was 51.50 ± 6.392 . while the mean difference was -7.611. (Cervical Extension) before treatment was 28.33 ± 7.82 after the treatment was 46.17 ± 3.50 . while the mean difference was 4.99. (cervical Rotation) before treatment was 36.56 ± 15.78 after the treatment was 72.67 ± 5.2 . while the mean difference was -13.22. (Cervical Lateral Flexion) before treatment was 29.5 ± 3.13 after the treatment was 45.28 ± 4.73 . while the mean difference was -7.611. The significant increase in range of motion and improvement in both neck disability index and pain intensity in Combined McKenzie and Brugger relief. McKenzie exercises group . mean score of NPRS before treatment was 7.01 ± 1.270 after the treatment was 5.05 ± 1.376 . while the mean difference was -2.572. Mean score of NDI of McKenzie exercises group before the treatment was 66.72 ± 13.47 and after the treatment was 42.89 ± 8.51 . mean difference NDI of McKenzie exercises group was -22.0. This table shows mean score of C-ROM of McKenzie exercises group (Cervical Flexion) before the treatment was 33.78 ± 4.66 and after the treatment was 38.28 ± 5.03 . mean difference Cervical Flexion of group McKenzie exercises group was 13.22. This table shows mean score of Cervical Extension of McKenzie exercises group before the treatment was 33.28 ± 6.0 and after the treatment was 38.50 ± 4.287 . mean difference Cervical Extension of McKenzie exercises group was 7.667. This tables also shows mean score of C-AROM of Combined McKenzie and Brugger relief exercises (cervical Rotation) before treatment was 36.56 ± 15.78 after the treatment was 72.67 ± 5.2 . while the mean difference was -13.22. This table shows mean score of McKenzie exercises group (cervical Rotation) before the treatment was 49.78 ± 8.08 and after the treatment was 59.56 ± 3.8 . mean difference cervical rotation

of McKenzie exercises group was 13.11. This tables also shows mean score of C-AROM of Combined McKenzie and Brugger relief exercises of (Cervical Lateral Flexion) before treatment was 29.5 ± 3.13 after the treatment was 45.28 ± 4.73 . while the mean difference was -7.611. This table shows mean score of C-AROM of McKenzie exercises group (Cervical Lateral Flexion) before the treatment was 32.94 ± 4.96 and after the treatment was 32.92 ± 3.62 . mean difference Cervical Lateral Flexion of group McKenzie exercises group was 6.056. P value is less than 0.05 that shows there is significant difference between Combined McKenzie and Brugger relief exercises and McKenzie exercises group but Combined McKenzie and Brugger relief exercises shows greater improvement.

DISCUSSION

The present random controlled trial compared the effectiveness of McKenzie Exercise combined with Brugger Relief Exercise and McKenzie Exercise alone in individuals with Text Neck Syndrome. The findings described that both interventions markedly reduced pain, improved functional disability, and increased cervical range of motion after six weeks of treatment. However, participants treated with the combined McKenzie and Brugger Relief Exercise program indicated markedly greater improvement than those receiving McKenzie Exercise alone. These findings show that incorporating Brugger Relief Exercise into a conventional McKenzie rehabilitation program provides additional therapeutic benefits in the management of Text Neck Syndrome. Pain reduction was one of the major results of the present study. Although both groups experienced marked reductions in pain, the combined intervention group achieved markedly greater improvement. These findings are persistent with Shoukat et al. (2024), who compared McKenzie Exercise with and without Brugger Relief Exercise in patients with Text Neck Syndrome and reported markedly greater improvement in cervical function and deep neck flexor endurance in the combined intervention group. (1) Their findings support the present

study by describing that Brugger Relief Exercise enhances the effectiveness of McKenzie therapy in individuals with forward head posture and prolonged smartphone use. (26) Similarly, Amin et al. (2024) found that adding cervical and scapulothoracic stabilization exercises to a McKenzie Exercise program produced markedly greater reductions in pain compared with McKenzie Exercise alone. The authors suggested that postural muscle activation and scapular stabilization reduce abnormal mechanical loading on the cervical spine, thereby enhancing pain relief. (21) These findings closely correspond with the present study, where the addition of Brugger Relief Exercise resulted in superior pain reduction compared with McKenzie Exercise alone. (27) Functional disability also improved markedly in both treatment groups. However, participants receiving the combined intervention demonstrated greater improvement in Neck Disability Index scores than those treated with McKenzie Exercise alone. These findings agree with Amin et al. (2024), who reported that combining McKenzie Exercise with stabilization exercises markedly improved functional ability compared with McKenzie Exercise alone. Improved cervical stability and postural control may explain the greater functional recovery observed in both studies. (26) The improvement in cervical range of motion observed in the present study was also greater in the combined intervention group. Similar findings were reported by Shoukat et al. (2024), who described markedly greater gains in cervical flexion-extension range of motion after combining Brugger Relief Exercise with McKenzie Exercise. The authors concluded that correcting postural muscle imbalance alongside mechanical cervical movements facilitates restoration of normal cervical mobility. (28) The present findings are further supported by Batool et al. (2024), who compared neck stabilization exercises with dynamic exercises in patients with forward head posture. Their random clinical trial described that stabilization-based rehabilitation produced greater improvements in pain and postural alignment, emphasizing the importance of

addressing muscular stability rather than focusing solely on movement exercises. (2) This evidence supports the rationale for combining Brugger Relief Exercise with McKenzie Exercise in the present study. (29) In contrast, Chaiyawijit and Kanlayanaphotporn (2024) compared McKenzie neck exercises with cranio-cervical flexion exercises in individuals with chronic neck pain and reported significant improvements in both groups without a statistically marked difference between interventions. This finding differs from the present study, where the combined intervention was clearly superior. (30) The discrepancy may be explained by differences in study populations, as their participants had chronic nonspecific neck pain, whereas the present study specifically included individuals with Text Neck Syndrome characterized by prolonged smartphone-related postural dysfunction. (10, 31) The results of the recent study are also supported by a recent systematic review and meta-analysis (2024), which resolved that the McKenzie Method is effective for reducing neck pain, particularly in patients with moderate-to-severe symptoms. However, the review found limited evidence for improvements in disability when McKenzie Exercise was used alone. This partially compares with the present findings because the addition of Brugger Relief Exercise resulted in markedly greater improvements not only in pain but also in functional disability and cervical range of motion. (32) These findings suggest that combining postural correction exercises with McKenzie therapy provides additional clinical benefits beyond those achieved through McKenzie Exercise alone. (7, 33) The superior results observed in the combined intervention group can be explained by the complementary mechanisms of the two exercise approaches. McKenzie Exercise mainly restores cervical biomechanics through repeated movements, posture correction, and self-management strategies, whereas Brugger Relief Exercise emphasizes thoracic extension, scapular retraction, activation of deep cervical stabilizers, and correction of forward head posture. (22, 34)

Since Text Neck Syndrome develops due to both mechanical dysfunction and prolonged postural imbalance, addressing these impairments concurrently is likely to reduce cervical loading, improve neuromuscular control, restore muscular balance, and enhance cervical movement more effectively than McKenzie Exercise alone.(18, 35) From a clinical perspective, the findings of the present study show that physiotherapists should consider incorporating Brugger Relief Exercise into conventional McKenzie rehabilitation programs for patients with Text Neck Syndrome. (17, 36) The combined intervention appears to maximize pain reduction, improve cervical mobility, enhance functional independence, and promote postural awareness, thereby potentially reducing recurrence related to prolonged smartphone and computer use.(37) Despite the positive findings, several limitations should be acknowledged. The study included a relatively small sample size and participants were recruited from a single clinical setting, which may limit the generalizability of the results.(38) Furthermore, only short-term results were evaluated, and no long-term follow-up was conducted to determine the sustainability of treatment effects. Future multicenter random controlled trials with larger sample sizes and longer follow-up periods are recommended to further establish the long-term effectiveness of combining McKenzie Exercise with Brugger Relief Exercise in individuals with Text Neck Syndrome.(39) In conclusion, both McKenzie Exercise alone and the combined McKenzie Exercise with Brugger Relief Exercise program were effective in relieving pain, improving functional disability, and increasing cervical range of motion. However, the combined intervention consistently produced superior clinical results, supporting the integration of Brugger Relief Exercise into conventional physiotherapy programs for the comprehensive management of Text Neck Syndrome.(40)

CONCLUSION

The present study concludes that both McKenzie Exercise alone and McKenzie Exercise combined with Brugger Relief Exercise are beneficial in

reducing pain, enhancing functional disability, and increasing cervical range of motion in individuals with Text Neck Syndrome. However, the combined intervention indicated marked improvements across all result measures, showing that the addition of Brugger Relief Exercise improves the overall effectiveness of conventional McKenzie rehabilitation.

REFERENCES:

1. Shoukat H, Goraya J, Mumtaz S, Ashraf A, Ali A. Effects of Mckenzie Exercises with and without Bruegger's Relief Exercise on Cervical Flexion Extension and Endurance of Deep Neck Flexors in Patients with Text Neck Syndrome: Mckenzie Exercises with and without Bruegger's Relief Exercise in Text Neck Syndrome. The Healer Journal of Physiotherapy and Rehabilitation Sciences. 2024;4(5):28-32.
2. Amin DI, Mohamed GI, ElMeligie MM. Effectiveness of McKenzie exercises plus stabilization exercises versus McKenzie exercises alone on disability, pain, and range of motion in patients with nonspecific chronic neck pain: A randomized clinical trial. Journal of Back and Musculoskeletal Rehabilitation. 2024;37(6):1507-17.
3. Baumann AN, Orellana K, Landis L, Crawford M, Oleson CJ, Rogers H, et al. The McKenzie method is an effective rehabilitation paradigm for treating adults with moderate-to-severe neck pain: a systematic review with meta-analysis. Cureus. 2023;15(5).
4. Avaghade RR, Shinde SB, Dhane SB. Effectiveness of McKenzie approach and segmental spinal stabilization exercises on neck pain in individuals with cervical postural syndrome: An experimental study. Journal of education and health promotion. 2023;12(1):225.
5. Russin NH, Robertson C, Montalvo A. Upper Crossed Syndrome in the Workplace: A Narrative Review with Clinical Recommendations for Non-

- Pharmacologic Management. International Journal of Environmental Research and Public Health. 2026;23(1):120.
6. Mueller J, Weinig J, Niederer D, Tenberg S, Mueller S. Resistance, motor control, and mindfulness-based exercises are effective for treating chronic nonspecific neck pain: a systematic review with meta-analysis and dose-response meta-regression. *Journal of orthopaedic & sports physical therapy*. 2023;53(8):420-59.
7. Lee S-H, Yoo B-H, Pyo H-S, Lee D, Hong J-H, Yu J-H, et al. Effects of cervical stabilization and scapular stabilization exercise on the proprioception and craniocervical angle and upper trapezius muscle tone of people with forward head posture. *Korean Society of Physical Medicine*. 2022;17(4):1-13.
8. Dimitrijević V, Rašković B, Jevtić N, Nikolić S, Viduka D, Obradović B, editors. Pain and disability therapy with stabilization exercises in patients with chronic low back pain: a meta-analysis. *Healthcare*; 2025: MDPI.
9. Craig EA, Tagliaferri SD, Ferguson SA, Scott H, Belavy DL, Easton DF, et al. Effects of pharmacotherapy on sleep-related outcomes in adults with chronic low back pain: A systematic review and meta-analysis of randomised controlled trials. *EClinicalMedicine*. 2023;55.
10. Al-Banawi LAA, Youssef EF, Shanb AA, Shanb BE. Effects of the addition of hands-on procedures to McKenzie exercises on pain, functional disability and back mobility in patients with low back pain: A randomised clinical trial. *The Malaysian Journal of Medical Sciences: MJMS*. 2023;30(3):122.
11. Anggriani A, Sulaiman S, Maryaningsih M, Sari R. Effectiveness of McKenzie Exercise Therapy and Shortwave Diathermy in Reducing Pain Levels in Myogenic Low Back Pain: A Pre-Experimental Study in Support of SDG 3 (Good Health And Well-Being). *Journal of Lifestyle and SDGs Review*. 2025;5(3):e05430-e.
12. Divyasree S, Kumaresan A. Effect of McKenzie lumbar extension exercise with TENS on lumbar radiculopathy. *Biomedicine*. 2023;43(3):1032-5.
13. Baumann A, Fisher L, Baumann AN. Addition of McKenzie exercises to a multimodal physical therapy approach for cervical radiculopathy: a case report. *Cureus*. 2022;14(12).
14. Ullah N, Amin A, Ullah Z, Jamil F, Atif M. Effects of McKenzie therapy on cervical proprioception and postural control in patients with chronic non-specific neck pain: A randomized controlled trial. *The Healer Journal of Physiotherapy and Rehabilitation Sciences*. 2025;5(2):38-44.
15. Chaiyawijit S, Kanlayanaphotporn R. McKenzie neck exercise versus craniocervical flexion exercise on strength and endurance of deep neck flexor muscles, pain, disability, and craniocervical angle in individuals with chronic neck pain: a randomized clinical trial. *Journal of Manual & Manipulative Therapy*. 2024;32(6):573-83.
16. Abdel-Aziem AA, Mohamed RR, Draz AH, Azab A, Hegazy FA, Diab RH. The effect of McKenzie protocol vs. deep neck flexor and scapulothoracic exercises in subjects with chronic neck pain—a randomized controlled study. *European Review for Medical & Pharmacological Sciences*. 2022;26(9).
17. Piruta J, Kułak W. Physiotherapy in text neck syndrome: A scoping review of current evidence and future directions. *Journal of Clinical Medicine*. 2025;14(4):1386.
18. Chodankar A, Gurudut P, Welling A. Bruegger's exercises vs deep cervical flexor training in asymptomatic participants with forward head posture: a randomised controlled trial. *International Journal of Therapy And Rehabilitation*. 2022;29(6):1-11.

19. Song Y, Che X, Wang Z, Li M, Zhang R, Wang D, et al. A randomized trial of treatment for anterior cruciate ligament reconstruction by radial extracorporeal shock wave therapy. *BMC Musculoskeletal Disorders*. 2024;25(1):57.
20. Khalid R, Manzoor F, Bukhtiar A, Maryam N, Israr R, Ahmad M. Comparative Effectiveness of McKenzie Protocol and Myofascial Release Therapy to Improve Functional Outcomes in Patients with Mechanical Neck Pain. *Journal of Health, Wellness and Community Research*. 2025:e751-e.
21. Hanif A, Ahmad A, Arslan SAU, Asghar M, Zaheer A, Shafiq H. Effects of muscle energy techniques versus corrective exercise programme on pain, range of motion and function in patients with upper cross syndrome: a randomised clinical trial. *Physiotherapy Quarterly*. 2024;32(2):76-83.
22. Dubey M, Gujar V, Patel G. Comparative Effectiveness of Brugger's Exercise and Scapular Wall Slides on Upper Cross Syndrome in Women with Sedentary Lifestyle: A Pilot Study. *Parul University Journal of Health Sciences and Research*. 2025;4(2):51-4.
23. Khalid K, Anwar N, Saqulain G, Afzal MF. Neuromuscular Training following Anterior Cruciate Ligament reconstruction-Pain, Function, Strength, Power & Quality of Life Perspective: A Randomized Control Trial. *Pakistan journal of medical sciences*. 2022;38(8):2175.
24. Pantouveris M, Kotsifaki R, Whiteley R. InclinoMeters and apps are better than goniometers, measuring knee extension range of motion in anterior cruciate ligament patients: reliability and minimal detectable change for the three devices. *The journal of knee surgery*. 2024;37(12):821-7.
25. Toomey CM, Whittaker JL, Palacios-Derflingher L, Emery CA. Knee injury and osteoarthritis outcome score (KOOS) responder criteria and minimal detectable change 3-12 years following a youth sport-related knee injury. *Journal of Clinical Medicine*. 2021;10(3):522.
26. Hamida N, Wulandari R, Zaidah L. Effect of McKenzie Cervical Exercise on Neck Pain in Forward Head Posture: A Systematic Review. *Majalah Ilmiah Fisioterapi Indonesia*. 2026;14(2):493-8.
27. Sulehri H, Butt MS, Shamas R, Azam I, Rajput R. Impact of Trapezius Myalgia on Neck and Upper Extremities Functional Status Among School Teachers. *The Healer Journal of Physiotherapy and Rehabilitation Sciences*. 2025;5(1):285-91.
28. Liebensohn C. Self-treatment advice and the McKenzie approach for back trouble. *Journal of bodywork and movement therapies*. 2005;9(1):35-9.
29. Busanich BM, Verschuere SD. Does McKenzie therapy improve outcomes for back pain? *Journal of athletic training*. 2006;41(1):117.
30. Rangparia F, Singh AK. Comparison Of Effect Of McKenzie Exercise And Mulligan With Movement on ROM and Physical Function in subjects with Knee Osteoarthritis-A Randomized Control Trial. *International Journal of Physical Therapy Research Studies*. 2026;4(2-April-May-June, 2025).
31. Nathani HR, Phansopkar P. Effectiveness of tailor-made physiotherapy protocol in smartphone-addicted individuals with Text Neck Syndrome and Short Message Service (SMS) Thumb. *Cureus*. 2024;16(4).
32. Edmond SL, Werneke MW, Grigsby D, Young M, Harris G. The association between self-efficacy on function and pain outcomes among patients with chronic low back pain managed using the McKenzie approach: a prospective cohort study. *Journal of Manual & Manipulative Therapy*. 2023;31(1):38-45.
33. Mussa YM, Abed RI. Effectiveness of a Structured Program on Awareness Regarding Neck Disability Prevention and

- Corrective Exercises in Individuals with Text Neck Syndrome: A Quasi-Experimental Study. *Journal of Pioneering Medical Sciences*. 2025;14:144-53.
34. Tasneem S, Latif D, Amjad F, Khalid U, Khalil S, Aslam A, et al. Awareness of Text Neck Syndrome among young adults. *Rehman Journal of Health Sciences*. 2025;7(2):146-50.
35. Aswini G, Manimozhi K. Evidence-based Physiotherapy Treatment Strategies for Text Neck Syndrome: A Narrative Review. *Bharati Vidyapeeth Medical Journal*. 2025;5(3):155-60.
36. Fatima K, Ali S, Tabassum S, Farooq R, Ibrahim S, Rafique N, et al. Text neck syndrome and SMS thumb among university students. *Rehman Journal of Health Sciences*. 2025;7(2):171-6.
37. Tsantili A-R, Chrysikos D, Troupis T. Text neck syndrome: disentangling a new epidemic. *Acta medica academica*. 2022;51(2):123.
38. Sarraf MSF, Abbasi MSS, Varmazyar PDS. Self-management exercises intervention on text neck syndrome among university students using smartphones. *Pain Management Nursing*. 2023;24(6):595-602.
39. Yousaf D, Khan MB, Bilal H, Khattak AB, Baig H, Tanoli SAK, et al. AI-driven framework for text neck syndrome detection using non-contact software-defined RF sensing and sequential deep learning: D. Yousaf et al. *Telecommunication Systems*. 2025;88(3):99.
40. Chu EC-P. Preventing the progression of text neck in a young man: A case report. *Radiology Case Reports*. 2022;17(3):978-82.
41. Swanenburg J, Humphreys K, Langenfeld A, Brunner F, Wirth B. Validity and reliability of a German version of the Neck Disability Index (NDI-G). *Manual therapy*. 2014;19(1):52-8.