

COMPARATIVE EFFECTS OF THE MCKENZIE TECHNIQUE AND INSTRUMENT-ASSISTED SOFT TISSUE MOBILIZATION IN FORWARD HEAD POSTURE PATIENTS WITH COEXISTING RESPIRATORY DYSFUNCTION

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ABSTRACT

Forward head posture (FHP) is among the most frequently observed deviations from normal cervical alignment and is associated with measurable changes in the strength and stiffness of the cervical musculature. The condition affects individuals across all age groups, from childhood to old age, and is closely linked to habitual behaviours such as prolonged computer and television use, mobile phone and video-game engagement, and the carrying of heavy backpacks, all of which encourage the body to adopt an abnormal head-forward alignment. Aim: This study aimed to compare the outcomes of the McKenzie technique and Instrument-Assisted Soft Tissue Mobilization (IASTM) in patients presenting with forward head posture and coexisting respiratory dysfunction. Objective: To determine the comparative effectiveness of the McKenzie technique and IASTM in improving cervical alignment, neck function, and respiratory performance in patients with forward head posture accompanied by respiratory dysfunction. Methodology: This experimental comparative study was conducted on 30 participants with forward head posture, aged between 20 and 40 years, who were allocated into two equal groups of 15 (Group A and Group B). Group A received the McKenzie protocol, while Group B was treated with Instrument-Assisted Soft Tissue Mobilization. Results: The findings demonstrated that the McKenzie technique produced greater improvement than IASTM in range of motion and forced vital capacity among participants with forward head posture and respiratory dysfunction. Conclusion: Although both interventions resulted in statistically significant improvement, the improvement observed in the group receiving the McKenzie technique was significantly greater than that observed in the group receiving IASTM, indicating that the McKenzie technique may be the more effective option for managing forward head posture in this population.

KEYWORDS: Forward head posture; Forced vital capacity; McKenzie technique; Instrument-assisted soft tissue mobilization; Craniovertebral angle; Neck disability index.

INTRODUCTION

Forward head posture (FHP) is one of the most common postural deviations encountered in clinical practice. It is characterised by an anterior displacement of the head and upper cervical spine relative to the plumb line that passes through the lateral malleolus in the sagittal plane. FHP is observed across the lifespan, from childhood through old age, and is particularly common among individuals engaged in sedentary or screen-intensive occupations.

Because the cervical musculature attaches directly to the vertebral column, changes in head position can plausibly extend their influence to respiratory mechanics. Prolonged postural dysfunction is generally accompanied by shortening of specific soft-tissue structures, which in turn compromises the biomechanical efficiency of breathing.

FHP is marked by increased flexion of the lower cervical segments together with increased extension of the upper cervical segments. Maintaining head alignment with the body's vertical centre of gravity is essential for minimising undue tension on the spinal musculature. Repetitive use of computers, television, mobile devices, video games, and heavy backpacks are frequently cited contributors to this abnormal alignment.

Clinically, FHP is quantified using the craniovertebral angle (CVA) — the angle formed between a horizontal line drawn through the C7 spinous process and a line connecting the C7 spinous process to the tragus of the ear. A CVA of less than 48–50 degrees is generally regarded as indicative of forward head posture.

FHP is associated with heightened activity of the sternocleidomastoid and upper trapezius muscles. Over time this pattern restricts diaphragmatic excursion, thereby reducing ventilatory efficiency and contributing to decreases in forced vital capacity (FVC) and forced expiratory volume in one second (FEV1). In the present study, respiratory performance was assessed using spirometry.

The McKenzie approach emphasises restoring flexibility to the musculature surrounding the cervical spine and re-establishing normal spinal alignment. Soft-tissue mobilisation techniques for FHP, in contrast, are directed at releasing tension within the sternocleidomastoid, upper trapezius, and levator scapulae — muscles that commonly shorten as a result of sustained forward head positioning. Instrument-Assisted Soft Tissue Mobilization (IASTM) employs specialised tools to break down fibrous adhesions and enhance the mobility of these tissues.

Left uncorrected, FHP can predispose individuals to cervical degenerative changes, spondylosis, radiculopathy, shoulder impingement, headache, and craniomandibular dysfunction. Reduced FVC and FEV1 have consistently been documented in individuals with FHP, largely attributable to compensatory reliance on accessory inspiratory muscles such as the scalenes and sternocleidomastoid rather than the diaphragm — a pattern often rooted in poor postural awareness during prolonged work activity.

Functional limitation related to neck symptoms is commonly assessed using the Neck Disability Index (NDI), a ten-item questionnaire in which each item is scored out of five, yielding a maximum total score of fifty (or its percentage equivalent out of one hundred). The index captures the impact of neck symptoms on activities such as personal care, lifting, reading, occupational tasks, driving, sleep, recreation, concentration, and headache, in addition to pain intensity.

Epidemiological reports suggest that FHP is widespread, with a prevalence of approximately 53.5% reported among children and adolescents, underscoring the importance of early postural awareness and ergonomic guidance. Sex-based

differences have also been described: the average craniovertebral angle in males with FHP is approximately 48.8°, most often occurring between 22 and 44 years of age, whereas in females it averages around 47.6°, typically between 28 and 66 years of age. A normal craniovertebral angle generally falls between 49.9° and 50°.

A range of conservative interventions — including McKenzie-based postural correction, stretching and strengthening exercise, electrical stimulation, and cervical traction — have been employed in the management of FHP. The growing dependence on mobile devices and laptops for both professional and personal use has amplified the prevalence of poor posture and faulty body mechanics across age groups, contributing not only to musculoskeletal complaints but also to reduced pulmonary function secondary to structural changes in the cervical and thoracic regions.

Need for the study

Despite the availability of several therapeutic approaches for FHP, comparative evidence regarding the McKenzie technique and IASTM — particularly with respect to coexisting respiratory dysfunction — remains limited. This study was undertaken to determine whether the McKenzie technique or IASTM is more effective in reducing forward head posture and its associated respiratory compromise.

Aim of the study

The aim of the study was to compare the effects of the McKenzie technique and instrument-assisted soft tissue mobilization in patients with forward head posture and coexisting respiratory dysfunction.

Objectives of the study

1. To assess the effect of the McKenzie technique on neck range of motion, quality of life, pain, and forward head posture.
2. To assess the effect of instrument-assisted soft tissue mobilization on neck range of motion, quality of life, and pain in patients with forward head posture.
3. To compare the effectiveness of the McKenzie technique and instrument-assisted soft tissue mobilization in improving neck range of motion, quality of life, pain, and forced vital capacity in patients with forward head posture and coexisting respiratory dysfunction.

Hypotheses

Null hypothesis (H0): There is no significant difference in the effectiveness of the McKenzie technique and instrument-assisted soft tissue mobilization in patients with forward head posture and coexisting respiratory dysfunction.

Alternative hypothesis (H1): There is a significant difference in the effectiveness of the McKenzie technique and instrument-assisted soft tissue mobilization in patients with forward head posture and coexisting respiratory dysfunction.

Review of literature

- Jabbar et al. (2024) described forward head posture as a postural malalignment of the neck that contributes to increased neck pain and reduced mobility, largely driven by poor posture and sedentary habits, with consequent changes in cervical muscle strength and stiffness.
- Kim et al. (2017) similarly reported alterations in cervical muscle strength and rigidity associated with forward head posture.

- Respiration depends on coordinated musculoskeletal and neural function, and abnormal posture has been shown to adversely affect this process. While interventions such as spinal mobilization, postural correction exercise, thoracic manipulation, and conventional therapy have been studied, evidence specifically addressing the McKenzie technique and IASTM together remains sparse.
- Liu, Wang et al. (2024) found that combining blood flow restriction training with IASTM and conventional strengthening improved ankle stability and functional outcomes.
- Das et al. (2024) reported that IASTM applied along the superficial back arm line may be more effective than treatment targeted at isolated muscles for chronic neck pain among computer professionals.
- Erina et al. (2023) found that cervical McKenzie exercise produced greater improvement in neck functional scores than cervical isometric exercise in patients with forward head posture.
- Avaghade et al. (2023) reported that the McKenzie approach was more beneficial than segmental spinal stabilization exercise for neck pain associated with cervical postural syndrome.
- Silva et al. (2023) demonstrated that forward head posture alters diaphragmatic movement, producing shallow, upper-chest-dominant breathing and limiting full diaphragmatic descent.
- Kim et al. (2022) found that combining cervical stabilization with stretching exercise improved cranial rotation angle, respiration, and joint range of motion in forward head posture, suggesting that a combined approach may better prevent and manage the condition.
- Dareh et al. (2022) recommended incorporating respiratory exercise into routine treatment for forward head posture and chronic neck pain to address abnormal breathing patterns alongside pain symptoms.
- Lee, Kim et al. (2022) observed a stronger relationship between respiratory muscle function and forward-head-related measures than with round-shoulder-related measures, suggesting that FHP may be a more direct contributor to reduced lung function.
- Choi et al. (2022) noted increased neck and upper trapezius tension in individuals with forward head posture, which restricts rib cage movement and affects lung function.
- Ahmed et al. (2021) found that posture-correction bands produced statistically and clinically significant effects on chest expansion.
- Liu et al. (2021) reported that individuals with forward head posture tend to rely on upper chest muscles such as the sternocleidomastoid and scalenes rather than the diaphragm, resulting in inefficient breathing patterns.
- Kim et al. (2020) found no significant change in pulmonary function following two hours of posture-correction-band use, although perceived exertion increased, suggesting a psychological rather than a physiological effect on breathing.
- Solakoglu et al. (2020) identified forward head posture as the most common postural disorder affecting neck and upper-extremity biomechanics as well as respiration, and recommended expiratory muscle strengthening alongside breathing re-education.
- Sheikhhoseini et al. (2018) found that therapeutic exercise produced substantial improvement in craniovertebral angle and moderate improvement in neck pain among patients with forward head posture.
- Kim, Dong-sung et al. (2017) demonstrated that IASTM improved soft-tissue function and range of motion while reducing pain in acute and chronic soft-tissue injuries.

MATERIALS AND METHODS

Study design and setting

This was a comparative experimental study conducted over a period of four weeks at Shri Isari Velan Mission Hospital, Thalambur. A total of 30 participants with forward head posture were recruited using a simple random sampling technique and were divided equally into two groups of 15 participants each (Group A and Group B).

Inclusion criteria

- Male and female participants
- Age group between 20 and 40 years
- Individuals with a reduced craniovertebral angle indicative of forward head posture
- Shoulder pain with a Numeric Pain Rating Scale (NPRS) score of less than 3

Exclusion criteria

- Recent fracture
- Open wound
- Tumour
- Osteoporosis
- Any neurological condition

Outcome measures

Neck Disability Index (NDI): a ten-section questionnaire used to identify difficulties associated with neck pain. Each section is scored on a 0–5 scale, where 0 indicates no difficulty and 5 indicates the greatest difficulty. Scores are interpreted as follows: 0–4 points, no disability; 5–14 points, mild disability; 15–24 points, moderate disability; 25–34 points, severe disability; and 35–50 points, complete disability.

Craniovertebral angle (CVA): defined as the angle formed at the intersection of a horizontal line passing through the C7 spinous process and a line joining the midpoint of the tragus of the ear to the skin overlying the C7 spinous process. A lower CVA value is associated with a greater degree of forward head posture; a CVA below 48–50° is classified as forward head posture.

Spirometry (pulmonary function test): used to evaluate lung function by measuring lung volumes, capacities, and flow rates. Reference thresholds applied were FVC and FEV1 $\geq$ 80%, and FEV1/FVC ratio $\geq$ 70%.

Materials required

- Spirometer
- Chair
- Treatment couch
- IASTM instrument

Procedure

A total of 30 participants who provided written informed consent were enrolled in the study after screening against the inclusion and exclusion criteria. Participants were randomly allocated to Group A (n = 15), who received the McKenzie

technique, or Group B (n = 15), who received Instrument-Assisted Soft Tissue Mobilization. Both groups underwent baseline assessment of craniovertebral angle, Neck Disability Index score, and spirometric parameters prior to the intervention, with reassessment following completion of the four-week treatment period.

Group A: McKenzie technique

Participants in Group A followed a McKenzie-based postural correction protocol consisting of a progressive sequence of exercises; where an exercise failed to produce symptomatic improvement after several days, progression to the next stage was undertaken.

The sequence comprised: retraction, retraction with patient-applied overpressure, retraction with clinician-applied overpressure, retraction combined with extension, and retraction combined with extension performed in supine lying. Each session consisted of 15 repetitions across 3 sets, performed daily for four weeks.

Group B: Instrument-Assisted Soft Tissue Mobilization

Participants in Group B received myofascial release using IASTM directed at trigger points within the sternocleidomastoid, upper trapezius, and suboccipital muscles. Patients were positioned in supine lying or sitting according to comfort. The instrument was applied at an angle of approximately 45° along the direction of the muscle fibres for 20 seconds, followed by application perpendicular to the fibres for a further 20 seconds, and a subsequent hold of 40 seconds. Suboccipital release and myofascial release of the upper trapezius were performed using metacarpophalangeal contact, together with release of the sternocleidomastoid. Treatment was delivered three sessions per week for four weeks.

RESULTS AND DISCUSSION

Data analysis

Data were analysed descriptively and inferentially. Descriptive statistics (count, minimum, maximum, mean, and standard deviation) were computed for all outcome measures in both groups. Normality of the data distribution was verified using the Shapiro–Wilk test prior to applying parametric inferential tests.

Table 1: Descriptive statistics of all outcome measures — Group A (McKenzie technique).

Measure	Count	Minimum	Maximum	Mean	SD
FEV1/FVC (pre)	15	0.61	0.69	0.64	0.03
FEV1/FVC (post)	15	0.61	0.74	0.67	0.04
CVA (pre)	15	24.8	39.8	32.45	4.17
CVA (post)	15	37.2	47.6	40.57	3.15
NDI (pre)	15	10	24	17.87	3.94
NDI (post)	15	5	15	10.0	2.93

Table 2: Descriptive statistics of all outcome measures — Group B (IASTM).

Measure	Count	Minimum	Maximum	Mean	SD
FEV1/FVC (pre)	15	0.51	0.68	0.59	0.05
FEV1/FVC (post)	15	0.53	0.69	0.6	0.05
CVA (pre)	15	26.5	38.3	32.39	3.83
CVA (post)	15	27.9	39.7	33.43	3.69
NDI (pre)	15	10	24	18.33	3.58
NDI (post)	15	8	20	14.53	3.34

In Group A, the mean FEV1/FVC ratio increased from 0.64 (SD = 0.03) before treatment to 0.67 (SD = 0.04) after treatment. The mean craniovertebral angle improved from 32.45° (SD = 4.17) to 40.57° (SD = 3.15), and the mean NDI score decreased from 17.87 (SD = 3.94) to 10.00 (SD = 2.93), reflecting improvement across all three measures.

In Group B, the mean FEV1/FVC ratio showed a modest increase from 0.59 (SD = 0.05) to 0.60 (SD = 0.05). The mean craniovertebral angle remained relatively stable, rising slightly from 32.39° (SD = 3.83) to 33.43° (SD = 3.69), while the mean NDI score decreased from 18.33 (SD = 3.58) to 14.53 (SD = 3.34). Overall, Group A demonstrated more pronounced improvement than Group B across all outcome measures, particularly in craniovertebral angle and NDI score.

Table 3: Shapiro–Wilk test of normality for all outcome measures.

Group	Outcome measure	Statistic	P-value	Decision
A	FEV1/FVC (pre)	0.93	0.277	Normal ($p > 0.05$)
A	FEV1/FVC (post)	0.94	0.423	Normal ($p > 0.05$)
A	CVA (pre)	0.98	0.966	Normal ($p > 0.05$)
A	CVA (post)	0.9	0.11	Normal ($p > 0.05$)
A	NDI (pre)	0.98	0.979	Normal ($p > 0.05$)
A	NDI (post)	0.98	0.973	Normal ($p > 0.05$)
B	FEV1/FVC (pre)	0.99	0.997	Normal ($p > 0.05$)
B	FEV1/FVC (post)	0.98	0.957	Normal ($p > 0.05$)
B	CVA (pre)	0.96	0.626	Normal ($p > 0.05$)
B	CVA (post)	0.96	0.644	Normal ($p > 0.05$)
B	NDI (pre)	0.97	0.803	Normal ($p > 0.05$)
B	NDI (post)	0.96	0.774	Normal ($p > 0.05$)

As the Shapiro–Wilk test yielded p-values above 0.05 for every outcome measure in both groups, the data were considered approximately normally distributed. Consequently, subsequent intra-group and inter-group comparisons were carried out using parametric tests — the paired-samples t-test for intra-group analysis and the independent-samples t-test for inter-group analysis.

Intra-group analysis — Group A

Table 4: Paired-samples t-test — Group A (pre- vs post-intervention).

Outcome measure	Pre-test mean (SD)	Post-test mean (SD)	t-value	p-value
FEV1/FVC	0.64 (0.03)	0.67 (0.03)	3.84	0.001
Craniovertebral angle	32.45 (4.17)	40.57 (3.15)	6.83	<0.001
Neck Disability Index	17.87 (3.94)	10.00 (2.93)	-9.86	<0.001

All three outcome measures showed statistically significant change from pre- to post-intervention in Group A ($p < 0.05$ in each case), indicating that the McKenzie technique produced a significant improvement in FEV1/FVC ratio, craniovertebral angle, and neck disability.

Intra-group analysis — Group B

Table 5: Paired-samples t-test — Group B (pre- vs post-intervention).

Outcome measure	Pre-test mean (SD)	Post-test mean (SD)	t-value	p-value
FEV1/FVC	0.59 (0.05)	0.60 (0.05)	6.97	<0.001
Craniovertebral angle	32.39 (3.83)	33.43 (3.69)	8.46	<0.001
Neck Disability Index	18.33 (3.58)	14.53 (3.34)	-14.51	<0.001

Group B also demonstrated statistically significant improvement across all three outcome measures from pre- to post-intervention ($p < 0.05$), confirming that IASTM produced a measurable, though comparatively smaller, treatment effect.

Inter-group analysis

Table 6: Independent-samples t-test comparing Group A and Group B.

Outcome measure	Group A mean change (SD)	Group B mean change (SD)	t-value	p-value
FEV1/FVC	0.03	0.01	2.16	0.039
Craniovertebral angle	8.12 (4.60)	1.03 (0.47)	5.93	<0.001
Neck Disability Index	-7.87 (3.09)	-3.80 (1.01)	-4.84	<0.001

The independent-samples t-test revealed a statistically significant difference between Group A and Group B for all three outcome measures ($p < 0.05$ in each case), with Group A consistently showing greater improvement than Group B in FEV1/FVC ratio, craniovertebral angle, and Neck Disability Index score. These findings indicate that the McKenzie technique was significantly more effective than IASTM across every outcome measure assessed in this study.

Summary of results

Taken together, the statistical analysis of craniovertebral angle, Neck Disability Index, and spirometric values indicates that both interventions produced measurable improvement in pain, disability, and cervical alignment. However, the magnitude of improvement was significantly greater in Group A, which received the McKenzie technique, than in Group B, which received IASTM.

DISCUSSION

This study set out to compare the effect of the McKenzie technique with that of instrument-assisted soft tissue mobilization in patients with forward head posture and coexisting respiratory dysfunction, with particular attention to pain, restricted range of motion, and quality of life. The comparative analysis of craniovertebral angle, Neck Disability Index, and spirometry scores at the end of the intervention period revealed a significant difference favouring the McKenzie group.

Cervical retraction, the initial exercise in the McKenzie extension protocol, encourages the lower cervical segments toward extension while the upper segments move toward relative flexion. This motion is thought to reduce mechanical loading on the intervertebral disc, particularly between C2 and C3, producing a decompressive effect that contributes to pain relief. Thabe and colleagues proposed that manual mobilization and manipulation promote reciprocal inhibition of the cervical flexor musculature, thereby reducing pain intensity and disability related to headache and neck pain. Stimulation of mechanoreceptors within the joint capsule has also been suggested as a contributing mechanism, inhibiting pain perception at the spinal cord level. As pain reduction appears to involve multiple overlapping mechanisms, further investigation of the underlying physiology is warranted.

In a systematic review, Clare and Adams similarly concluded that McKenzie therapy was statistically significantly more effective than comparator treatments in reducing short-term pain and disability, a finding consistent with the outcomes observed in the present study.

Dunning has suggested that IASTM tools, such as those used in the Graston technique, address tissue restriction within the cervical spine and surrounding musculature in patients with forward head posture. In the present study, participants

receiving IASTM did experience measurable, though more modest, improvement in pain, neck range of motion, and perceived functional capacity, indicating that the technique retains clinical value even where the McKenzie approach produced superior outcomes.

Limitations

- The sample size used in this study was relatively small.
- An equal number of male and female participants was not maintained.
- The sample was restricted to participants aged 20 to 40 years.
- A limited set of outcome measures was used to evaluate treatment effect.

Recommendations

- Future studies should be conducted with a larger sample size to strengthen generalisability.
- Long-term follow-up is recommended to determine the durability of treatment effects.

CONCLUSION

Both interventions were effective in improving cervical range of motion and reducing pain and disability among participants with forward head posture and coexisting respiratory dysfunction. However, the McKenzie technique (Group A) produced significantly greater improvement than Instrument-Assisted Soft Tissue Mobilization (Group B), suggesting that it may be the preferable intervention for this patient population.

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