

Effectiveness of McKenzie Exercise and Chest Mobility Exercise in Forward Head Posture on Respiratory Function

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Received: 10th Mar, 2026 | Revised: 18th Mar, 2026 | Accepted: 22nd Mar, 2026 | Available Online: 28th Mar, 2026

ABSTRACT

Background - Forward head posture, the head is positioned anterior to body's centre of gravity where lordosis is increased in upper cervical region and decreased in lower cervical region. The prevalence of forward head posture in India for age group (18-30 yrs) is 73 %.

Aims of the study – To study the effectiveness of Mckenzie exercise and Chest Mobility exercise in forward head posture on respiratory Function.

Procedure- Ethical clearance was obtained from Institution Ethical Committee. Total 60 participants were included in this study according to the inclusive criteria. The 60 participants were given a combined therapy of Mckenzie exercise and chest mobility exercise for 5 days in a week.

Outcome measures- Craniovertebral angle, Chest wall measurement to study the effectiveness of Mckenzie exercise and Chest Mobility exercise in forward head posture on respiratory Function.

Result- Chest expansion at the axillary, nipple, and xiphoid levels increased significantly following the exercise program, indicating enhanced thoracic mobility and respiratory function. Additionally, the craniovertebral angle showed a notable increase after the intervention, reflecting an improvement in forward head posture. These findings suggest that the combined application of McKenzie exercises and chest mobility exercises is effective in improving respiratory function and correcting forward head posture by enhancing chest expansion and improving cervical alignment

Conclusion- The 4-week study demonstrated that an intervention combining Mckenzie exercises and chest mobility exercises significantly improved the craniovertebral angle and chest expansion in individuals with forward head posture. the findings emphasize the importance of exercise-based postural correction as an effective and non-invasive approach for improving respiratory function and managing forward head posture (FHP).

Keyword's – Forward Head Posture, Craniovertebral Angle, Chest mobility, Chest wall measurement, Postural Correction, Mckenzie Exercise, Chest mobility exercise.

How to cite this article: Miss. Rajnandini Anil Bhale¹ Dr. Javid Hussain Sagar^{2*}. Effectiveness of McKenzie Exercise and Chest Mobility Exercise in Forward Head Posture on Respiratory Function. Int J Drug Deliv Technol. 2026;16(82s):739-746. DOI: 10.25258/ijddt.16.82s.84.

INTRODUCTION

In order to complete the duties demanded of them, some occupations now require workers to spend extended hours in static, sedentary positions. The majority of people have a forward head posture (FHP), in which their chins protrude, as a result of this persistent muscle contraction in the neck and shoulders ⁽²⁾.

The ability of skeletal muscles to regulate the relative postures of body parts in relation to gravity and one another throughout daily activities is known as postural orientation. Soft tissue weakness and adaptive shortening are characteristics of postural dysfunction ^[8]. Increased flexion of the cervical and upper thoracic area, increased occiput extension on the first cervical vertebrae, and increased extension of the upper cervical vertebrae are characteristics of the forward

head posture. In forward head posture, the head is positioned ahead of the body's center of gravity, with the lower cervical area having less lordosis and the upper cervical region having more. Individuals who use computers in a fixed position for extended periods of time typically have forward head posture. ⁽²⁾

The sternocleidomastoid [scm], scalene, suboccipital, and levator scapulae muscles in the neck and shoulder may be constantly contracted as a result. This generates tension in the upper trapezius, which leads most people to adopt a forward head posture where their chin protrudes. This causes the cervical spine's overall curvature to rise, strains the entire posterior spinal muscle system, especially in the thoracic and cervical regions, and impairs breathing. Aletration in muscle activity results from changes in motor

strategies to compensate for repressed muscles and reduce the activity of muscles that sense pain⁽²⁾

Text neck syndrome, generalized neck discomfort, cervical spine degeneration, myofascial trigger points, headaches, temporomandibular problems, shoulder abnormalities, and respiratory impairments are some of the most prevalent conditions linked to FHP. In order to help prevent the beginning and chronicity of musculoskeletal disorders, FHP adjustment is necessary. FHP may last a lifetime due to degenerative musculoskeletal disease and spinal remodeling if it is not treated in early or middle adulthood. ⁽¹³⁾

The two lungs that make up the human respiratory system are divided by the mediastinal structure. The lung's functional unit, the alveolus, can number up to 300 million in an adult lung. When the alveoli are unrolled, they offer an

85 m² surface area for gas exchange with the surrounding capillaries. The respiratory system's muscles support the lungs to enable physiological inspiration, which permits atmospheric air to enter the lungs. This procedure is sometimes referred to as quiet breathing. It is evident that the ribcage rises during inspiration, enlarging the entire thoracic cavity to accommodate the expansion of the lungs; on the other hand, the ribcage falls during expiration as a recoil action of the silent breathing process. The recruitment of supplementary respiratory muscles occurs when breathing is difficult. The internal intercostal and abdominal muscles reversely compress the ribcage downward and inward to cause laborious expiration, while the scalene and sternocleidomastoids actively mobilize the ribcage upward and outward during inspiration. Using these muscles will make breathing more energy-intensive, which will lead to more exhaustion ⁽¹⁴⁾.

Effective breathing is essential for the human body to function well. In addition to altering the mobility of the cervical region, forward head posture can cause abnormal changes in the anatomical structure of the cervical and thoracic sections of the spine, which can alter respiratory function. Additionally, dysfunction of the global and local muscle systems can lead to imbalance and instability of individual spinal segments ⁽¹⁾.

Respiratory muscle weakness results from abnormal head posture, which also affects alveolar ventilation, thoracic expansion, and lung volume and capacity. The diaphragm's ability to move and operate is hampered by forward head posture, which also results in ineffective abdominal muscular contraction that reduces lung capacity. Additionally, as sternocleidomastoid muscle tone increases, forward head posture causes thoracic elevation. As a result, the thoracolumbar area becomes less mobile, which reduces the diaphragm's ability to function as a

ventilator. The respiratory muscle's inefficiency reduces its strength and thoracic expansion, which impairs the lungs' ability to operate as a ventilator during physical exertion ⁽¹⁾

The McKenzie exercise is a repeated, self-therapeutic activity that emphasizes extension. The most common cause of neck pain is bad posture, which puts too much strain on the cervical region's soft tissue and ligaments. This results in alterations to the cervical spine's soft tissue and structure, which diminishes its functionality and produces pain. Self-therapeutic exercise, mobilization, manipulation, and patient education are all part of the McKenzie exercise's therapeutic approach. Additionally, it can enhance patients' functioning and lessen pain recurrence and related stress. Patients with chronic neck pain saw a considerable improvement in shoulder posture after doing the McKenzie exercise, which is a popular treatment intervention for musculoskeletal issues. Additionally, individuals with neck pain who performed McKenzie exercises reported improved function, reduced pain, and altered posture. ⁽¹⁾

Chest mobility exercises extend the afferent activities of both external and internal intercostal muscle spindles to reduce dyspnea, minimize respiratory muscle atrophy, and support coordinated contractions of the respiratory muscles. The tightness of accessory muscles results in reduced chest expansion and rib cage movement, which can cause hyperinflation and a chronic decrease in the diaphragm's opposition zone. Lengthening the soft tissues surrounding the chest wall and respiratory muscles effectively enhances contraction force and chest movement, improves lung volumes, controls breathing, and increases the efficacy of respiratory muscles while promoting respiratory mechanics. ⁽³⁾

METHODOLOGY

A quasi experimental Interventional Study Conducted at D. Y. Patil college of physiotherapy on study subjects with forward head posture. Study subjects were selected according to inclusion and exclusion criteria. The study started after getting ethical approval and conducted for a duration of 6 months. Sample size was 60.

Inclusion criteria: Physical ability -Able to perform physical exercise (McKenzie and chest mobility exercise) independently, age: 18-29years, consent – Willing to participate and provide informed written consent, Patient with forward head posture.

Exclusion criteria: History of Cervical trauma, Neck Fracture, Recent or previous surgery of neck, History of Congenital neck deformities, Specific causes of neck pain (conditions with neurological involvement such as myelopathy with weakness, numbness and sensory loss, cervical disc prolapsed and spinal stenosis.

PROCEDURE

The study protocol was submitted for approval to the Institutional Ethical Committee and Protocol Committee of Dr. D. Y. Patil Education Society Institution (Deemed to be University), Kolhapur, and D.Y. Patil College of Physiotherapy, Kolhapur. After receiving ethical clearance, eligible participants from Kolhapur city will be approached. The purpose of the study and procedures will be clearly explained, and written informed consent will be obtained from all willing participants.

Participants will be screened according to the inclusion and exclusion criteria. Basic demographic data including name, age, gender, BMI, occupation will be collected on a standardized data collection sheet.

On the basis of consecutive sampling method, the participants will be allocated into group. Craniovertebral angle and chest wall measurement will be taken before the interventions. Intervention will be given for 6 weeks. At the end of 6 weeks participants will be assessed for outcome measures again. Period of intervention will be 6 weeks.

McKenzie Exercise

Exercise 1: Head retraction in sitting

Head retraction means pulling the head backwards. sit on a chair or stool, look straight ahead and allow yourself to relax completely. Your head will protrude a little as you do this (fig.a) Now you are ready to start the first and most important exercise.

Move your head slowly but steadily backwards until it is pulled back as far as you can manage (fig.b). It is important to keep your chin tucked down and in as you do this. In other words, remain looking straight ahead, being careful not to tilt the head backwards as in looking up. When your head is pulled back as far as possible, you have assumed the retracted head posture. once you have maintained this position for a few seconds, relax, and automatically your head and neck will protrude again each time you repeat this movement cycle make sure that the backward movement of head and neck is performed to the maximum possible degree the exercise can be made more effective by adding overpressure.

This is done by placing both hands on the chin and firmly pushing the head back even further

Hold 3–5 seconds, then relax.

Reps: 10 reps × 2–3 sets

Exercise 2-Neck extension in sitting

Extension means bending backwards. This exercise should always follow Exercise 1.

remain seated, repeat Exercise 1 a few times, and then hold your head in the retracted position. **Now you are ready to start Exercise 2.**

lift your chin up and tilt your head backwards as in looking up at the sky. Do not allow your neck to move

forwards as you do this with your head tilted back as far as possible, you must rotate your head from side to side so that your nose moves just half an inch (about 2 cm) to the right and then to the left of the midline, all the time attempting to move head and neck even further backwards. Repeat this movement quite rhythmically and not too slowly.

once you have done this for a few seconds, return your head to the starting position. Again, each time you repeat this movement cycle make sure that neck extension is performed to the maximum possible degree.

Exercise 3: Head retraction in lying- Lie face up with your head at a free-standing edge of the bed - for example, lie across a double bed or with your head at the foot-end of a single bed. Rest your head and shoulders flat on the bed and do not use a pillow.

Now you are ready to start Exercise 3.

Push the back of your head into the mattress and at the same time pull your chin in. The overall effect should be that your head and neck move backwards as far as possible while you keep facing the ceiling.

Once you have maintained this position for a few seconds, you should relax and automatically the head and neck return to the starting position. Each time you repeat this movement cycle, make sure that the backward movement of head and neck is carried out to the maximum possible degree.

Exercise 4: Neck extension in lying

This exercise should always follow Exercise 3. Again, you must lie face up on the bed.

before you start Exercise 4 place one hand under your head and move up along the bed until the head, neck and the top of your shoulders are extended over the edge of the bed.

while supporting your head with one hand lower it slowly down towards the floor.

now remove your hand, tilt your head and neck as far backwards as you can and try to see as much as possible of the floor directly under you in this position repeatedly rotate your head from side to side so that your nose moves just half an inch (about 2 cm) to the right and then to the left of the midline, attempting to move your head and neck further backwards as you do this.

Repeat this movement quite rhythmically and not too slowly.

once you have reached the maximum amount of extension, try to relax in this position for about thirty seconds

in order to return to the resting position, first place one hand behind your head, then assist your head back to the horizontal position and move down along the bed until your head is lying on the bed again

Chest mobility exercise

Lateral Flexion (Side Bending) with Breathing

Starting position: Standing or sitting.

Procedure

Raise the **right arm over the head**.

Bend the trunk to the **left side while inhaling deeply**.

Return to upright position while **exhaling**.

Repeat on the opposite side.

Repetitions: 5–10 each side

Purpose: Stretches intercostal muscles and improves chest wall mobility.

Shoulder Elevation with Deep Breathing

Starting position: Sitting or standing.

Procedure

Arms relaxed at the side.

Raise both arms upward during deep inspiration.

Lower the arms slowly while **exhaling**.

Repetitions: 8–10 repetitions

Purpose: Improves rib cage expansion and chest mobility.

Shoulder Retraction Exercise

Starting position: Sitting.

Procedure

Arms relaxed by the side.

Pull the **shoulders backward** while taking a deep breath.

Relax the shoulders while breathing out.

Repetitions: 8–10 times

Purpose: Opens the chest and increases anterior chest mobility.

RESULT

The study evaluating the effectiveness of McKenzie exercise and chest mobility exercise on respiratory function in individuals with forward head posture revealed a significant improvement in post-intervention outcomes. Chest expansion at the axillary, nipple, and xiphoid levels increased significantly following the exercise program, indicating enhanced thoracic mobility and respiratory function. Additionally, the craniovertebral angle showed a notable increase after the intervention, reflecting an improvement in forward head posture. These findings suggest that the combined application of McKenzie exercises and chest mobility exercises is effective in improving respiratory function and correcting forward head posture by enhancing chest expansion and improving cervical alignment.

GENDER DISTRIBUTION

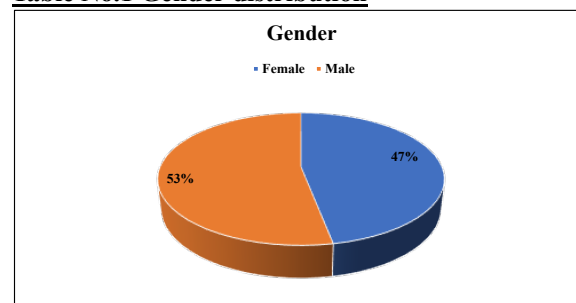
Table 1 presents the gender distribution of the total participants. Among the 66 participants, 35 were male and 31 were female.

Graph 1 illustrates the percentage distribution, showing that males are accounted for 53% of the total, while females comprised 47%.

GENDER DISTRIBUTION

Gender	Frequency	Percentage
Female	31	47%
Male	35	53%
Total	66	100%

Table No.1 Gender distribution



Graph No.1 Gender distribution

AGE WISE DISTRIBUTION

Table 2 presents the age-wise distribution of participants in **Group A** (90/90 Ball & Balloon Exercise) and **Group B** (Buteyko Breathing Exercise). The mean age for Group A was 53 years (S.D. 6.23), while Group B had a mean age of 51.6 years (S.D. 7.06).

Graph 2 illustrates graphical representation of the mean ages, showing a similar distribution across both the groups indicating that age is evenly distributed among participants within the two exercise groups, as illustrated in the graphical comparison.

	Mini mum	Ma xim um	M ea n	Std. Deviation			
Age	19	24	21 .6 8	1.35			
Vari able	Exercise Group				M ea n	S · D ·	P- val ue
Age	90/90 BALL AND BALLOON EXERCISE				53	6 · 6	0.2 56 6

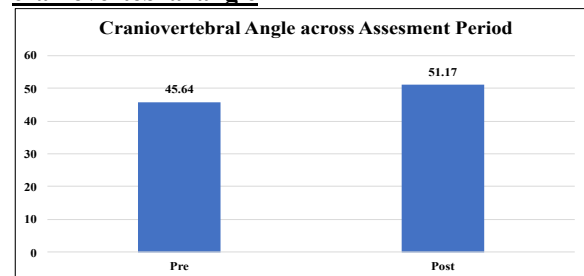
			2	
			3	
			7	
	BUTEYOKO	51	.	
	EXERCISE	.6	0	
			6	

Table No. 2 Age Distribution**B. PRE & POST INTERVENTION OF CRANIOVERTEBRAL ANGLE**

Table 3 presents the pre- and post-intervention values of craniovertebral angle (McKenzie and chest mobility exercise). The results show a significant improvement, with **craniovertebral angle** increasing from a mean of **45.64 to 51.17** (P-value: <0.001*)

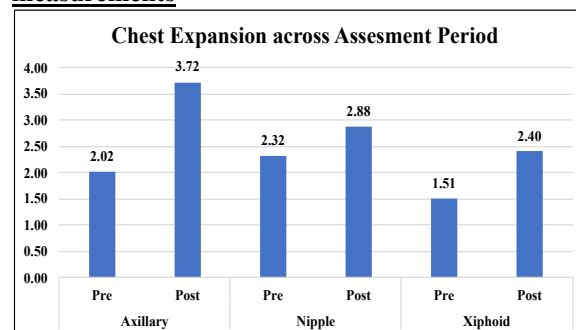
Graphs 3 visually depict the pre- and post-intervention mean values of craniovertebral angle in forward head posture

Craniovertebral Angle	Mean	Std. Deviation	p-value
Pre	45.6	1.82	<0.001*
Post	51.1	1.71	

Table No 3- pre and post intervention of craniovertebral angle**Graph No. 3 -Pre and post intervention of craniovertebral angle****C. PRE & POST INTERVENTION OF CHEST WALL MEASUREMENT**

Tables 4 represent the pre- and post-intervention of chest wall measurement at different levels (Axillary, Nipple, Xiphoid). The results indicate that the median difference between pre- and post-intervention scores is **zero**, with a significance level of <0.001*, leading to the rejection of null hypothesis. Graphs 4 visually represent the chest wall measurements at different anatomical levels before and after the intervention, demonstrating a significant improvement of scores following the intervention.

Chest Expansion	Assessment Period	Mean	Std. Deviation	p-value
Axillary	Pre	2.02	0.46	<0.001*
	Post	3.72	0.62	
Nipple	Pre	2.32	0.46	<0.001*
	Post	2.88	0.56	
Xiphoid	Pre	1.51	0.57	<0.001*
	Post	2.40	0.45	

Table no -4 pre and post intervention of chest wall measurements**Graph no. -4 pre and post intervention of chest wall measurements**

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig. ^{a,b}	Decision
1	The median of differences between Pre and Post equals 0.	Related-Samples Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.
a. The significance level is .050.				
b. Asymptotic significance is displayed.				

Table No. 4a

Related-Samples Wilcoxon Signed Rank Test Summary	
Total N	20
Test Statistic	.000
Standard Error	23.479
Standardized Test Statistic	-4.472
Asymptotic Sig.(2-sided test)	<.001

Table No. 4b Pre-Post Intervention of Borg Scale in Group

DISCUSSION

This study titled “Effectiveness of Mckenzie and chest mobility exercise in forward head posture on respiratory function”. It is focused on evaluating the impact of a corrective exercise program designed to improve craniovertebral angle (CVA) and chest wall mobility in individuals. This discussion will analyse the findings, implications, and comparisons with previous studies, along with the broader impact on postural health in the students

Impact Of Forward Head Posture (FHP)

Forward head Posture characterized by increased flexion of cervical and upper thoracic region, increased extension of occiput on the first cervical vertebrae and increased extension of upper cervical vertebrae. Forward head posture ,the head is positioned anterior to body's center of gravity where lordosis is increased in upper cervical region and decreased in lower cervical region .People who spend a lot of time using computers in fixed position tend to have forward head posture.⁽²⁾ This can result in constant contraction of neck and shoulder muscles which are sternocleidomastoid [scm] , scalene muscles , suboccipital muscles and levator scapulae this create tension in upper trapezius which causes most people to adopt a forward head posture where their chin protrude .This lead in increase in total curvature of the cervical spine and places strain on the complete posterior spinal muscular system , particularly in cervical region and thoracic region and affects respiratory function they are as follows :

Affects thoracic expansion, alveolar ventilation.

Decrease lung volume and capacity, resulting in respiratory muscle weakness. impairs the mobility and function of the diaphragm and causes inefficient contraction of abdominal muscles, decreasing lung capacity.

Thoracic elevation as muscle tone of the sternocleidomastoid is increased.

Mobility of thoracolumbar region decreases, leading to decreased ventilator function of the diaphragm.

Inefficient function of the respiratory muscle decreases its strength and thoracic expansion, hence, the ventilator function of the lungs needed during physical activity becomes impaired.⁽¹⁾

Key Findings and Their Implications

The study analysed 60 students, assessing their craniovertebral angle and chest expansion before and after the intervention. The results indicated statistically significant improvements in posture and chest mobility, supporting the effectiveness of targeted corrective exercises.

Improvement in Craniovertebral Angle

Pre-intervention CVA: $45.64^{\circ} \pm 1.82$

Post-intervention CVA: $51.17^{\circ} \pm 1.71$

P-value: <0.001* (highly significant)

Forward head posture was defined as CVA of less than 49° . Smaller CVA indicates greater forward head posture.⁽¹⁾ In the present study, the CVA of the experimental group significantly increased from 45.64° pre-exercise to 51.17° post-exercise. The results indicated statistically significant improvements in posture by increasing craniovertebral angle, supporting the effectiveness of targeted corrective exercises

Increased chest expansion

Axillary (Pre: 2.02 ± 0.46 , Post: 3.72 ± 0.62 , $P = <0.001^*$)

Nipple (Pre: 2.32 ± 0.46 , Post: 2.88 ± 0.56 , $P = <0.001^*$)

Xiphoid (Pre: 1.51 ± 0.57 , Post: 2.40 ± 0.45 , $P = <0.001^*$)

The results demonstrate significant improvements in chest expansion across axillary, nipple, and xiphoid levels following interventions combining McKenzie exercises and chest mobility exercises in individuals with forward head posture (FHP).

Comparison with Previous Studies

Several prior studies have examined the role of postural corrective exercises in treating forward head posture, and the findings of this study are consistent with their results.

SeYoon Kim et al. (2019). his study investigate the effects of the McKenzie exercise program on forward head posture and respiratory function. The present study aimed to determine the effects of the McKenzie exercise program on forward head posture and respiratory function. In the group undergoing McKenzie exercise, forward head posture, FVC, FVC %pred, FEV1, and FEV1 %pred were significantly improved after intervention. Despite a small sample size and lack of long-term follow up, it is suggested that McKenzie exercise will be effective in improving forward head posture and respiratory function.⁽¹⁾

Shreya Joshi et al. (2019) conducted a study of effect of mckenzie self-therapy protocol on forward head posture and respiratory functions of school going adolescent girls. Their results showed that Mckenzie

self therapy exercises were superior in reducing FHP, supporting the efficacy of combined interventions such as the one used in this study. ⁽⁸⁾

Katherine Harman et al. (2023) investigated the Effectiveness of an Exercise Program to Improve Forward Head Posture in Normal Adults: A Randomized, Controlled 10-Week Trial. The current study observed similar improvements in just 4 weeks, suggesting that even a short-term intervention can be beneficial in reducing forward head posture. ⁽¹⁵⁾

Mohtishim Ahmed et al. (2024) demonstrated that a 4-week corrective exercise program was effective in improving postural alignment related to FHP and improving respiratory function and chest expansion. This directly supports the methodology and findings of the present study, reinforcing that a short-duration intervention can yield significant results. ⁽³⁾

These comparisons indicate that for forward head mckenzie exercises, when combined with chest mobility exercises, offer an effective and efficient solution for improving postural health and improve respiratory function in individuals with FHP

Mechanism Behind Improvement

The success of the intervention can be attributed to the following physiological and biomechanical factors:

Forward head posture can give rise to abnormal changes in the anatomical structure of the cervical and thoracic sections of the spine leading to changes in respiratory function. In addition, changes in mobility of the cervical region, improper head posture, and dysfunction of global and local muscle systems result in muscle imbalance and instability of individual spinal segment. ⁽¹⁾

Strengthening Weak Muscles

cervical flexors namely, Deep Cervical Flexors and the cervical extensors namely, Suboccipitals. Literature states that in order to correct the posture and maintain it to prevent recurrence, strengthening of deep cervical flexors and stretching of sub-occipitals is necessary. ⁽⁶⁾

Improvement in chest mobility

It Lengthen soft tissues around the chest wall and respiratory muscles helps efficiently in the contraction force and the chest movements by gaining the lung volumes, breathing control, muscle length would increase the efficacy of respiratory muscles and promote respiratory mechanics. ⁽³⁾

CONCLUSION

The 4-week study demonstrated that an intervention combining Mckenzie exercises and chest mobility exercises significantly improved the craniovertebral angle and chest expansion in individuals with forward head posture. the findings emphasize the importance of exercise-based postural correction as an effective and non-invasive approach for improving respiratory function and managing forward head posture (FHP).

Furthermore, these exercises contributed to improved chest expansion and thoracic mobility, which may enhance overall respiratory efficiency. considering the increasing prevalence of postural disorders and their impact on respiratory function, incorporating corrective exercises into daily routines may significantly improve postural alignment, respiratory health, and overall well-being.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to research, authorship and / or publication of this article.

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