

Effectiveness of Breathing Exercises Along with Conventional Exercises on Rib Cage Mobility and Postural Alignment in Ankylosing Spondylitis Patients: A Randomized Controlled Trial

Dr. Sapna Kumari PT¹, Dr. Deepak Rajpurohit PT²,
Dr. Gajendra Suthar PT³

¹MPT Orthopedics, Department of Physiotherapy and Occupational Therapy Vivekananda global university, Jaipur.

²Associate Professor & Vice Principal, Swasthya Kalyan College of Physiotherapy, Sitapura, Jaipur

³Physiotherapist, Dcore Physiotherapy Center, Pratap Nagar, Jaipur

Abstract

Background: A chronic inflammatory disease that mostly affects the axial skeleton, ankylosing spondylitis (AS) causes gradual rigidity of the spine, postural abnormalities, and decreased mobility of the rib cage. Reduced quality of life and compromised respiratory function are frequent outcomes of these alterations. The extra advantages of breathing exercises on thoracic expansion and posture are still not well understood, despite the fact that traditional physiotherapy is crucial in treating mobility and discomfort.

Objective: To assess the impact of breathing techniques in conjunction with traditional physical treatment on ankylosing spondylitis patients' postural alignment and rib cage mobility.

Methodology: 60 people with AS diagnoses, ages 20 to 50, participated in a randomized controlled trial (RCT). Participants were split into two groups at random: a control group that received only conventional physiotherapy and an experimental group that received both conventional physiotherapy and breathing exercises. Over the course of three months, the intervention was implemented. The main results were postural alignment and rib cage mobility (chest expansion at the xiphoid level, second ICS, and fourth ICS). Respiratory function (FVC, FEV1), discomfort (VAS), functional disability (BASDAI), and quality of life (ASQoL) were secondary objectives.

Result: Both groups showed statistically significant improvements in thoracic mobility and chest expansion ($p < 0.05$). Nonetheless, the experimental group outperformed the control group at every measured level of chest expansion. The greatest improvement was seen in the xiphoid level (5.11 ± 0.47 cm in experimental versus 4.01 ± 0.34 cm in control). Additionally, the experimental group demonstrated better functional results, reduced discomfort, enhanced thoracic mobility, and improved respiratory metrics.

Conclusion: When breathing exercises are added to traditional physical treatment, patients with

ankylosing spondylitis experience improved rib cage mobility, postural alignment, and overall functional outcomes. For improved long-term management of since, this combination approach should be **taken into consideration in clinical practice since it provides a comprehensive rehabilitation strategy.**

Keywords: Ankylosing Spondylitis, Breathing Exercises, Rib Cage Mobility, Postural Alignment, Physiotherapy, Respiratory Function.

Introduction

Ankylosing spondylitis (AS) is a long-term inflammatory condition that affects the costovertebral joints, sacroiliac joints, and spine. Back pain, morning stiffness, thoracic rigidity, limited spinal mobility, bad posture, and diminished chest expansion are frequently reported by patients. Thoracic kyphosis, forward head posture, rounded shoulders, and decreased lumbar lordosis are examples of progressive postural abnormalities that have a substantial impact on functional independence and quality of life. According to research, AS patients' chest expansion, respiratory function, spinal mobility, discomfort, and quality of life are all improved by breathing exercises, inspiratory muscle training, Pilates, stretching, and posture correction. However, few long-term randomized controlled trials have looked at the combined impact of breathing exercises and traditional physiotherapy on postural alignment and rib cage mobility.

Objectives:

1. To evaluate the effectiveness of breathing exercises combined with conventional physiotherapy on rib cage mobility in AS patients.
2. To evaluate the impact on thoracic mobility and postural alignment.
3. To assess respiratory function improvements (FVC and FEV1).
4. To assess how pain, functional impairment, and quality of life have changed.
5. Randomized Controlled Trial (RCT) is the study design.

Materials and Methods

In order to compare the efficacy of conventional physiotherapy in conjunction with breathing exercises versus conventional physiotherapy alone in enhancing rib cage mobility, postural alignment, respiratory function, pain, functional disability, and quality of life in patients with ankylosing spondylitis (AS), this study was designed as a Randomized Controlled Trial (RCT). Trained physiotherapists oversaw all evaluations and interventions during the trial, which was carried out in hospital-based physiotherapy departments, rheumatology clinics, and rehabilitation facilities.

There were 60 individuals with AS who were between the ages of 20 and 50 and had both radiological and clinical diagnoses. Participants have to be able to give informed permission and have moderate to severe difficulties in postural alignment and rib cage movement. Pregnancy, recent spinal surgery or fractures, severe cardiovascular or respiratory conditions, and cognitive impairments were all excluded.

Using a computer-generated randomization technique with sealed opaque envelope allocation concealment, participants were divided into two groups at random. While the control group only received standard physiotherapy, the experimental group also received breathing exercises. Spinal mobility exercises, postural correction exercises, and strengthening and stretching of the Para spinal,

chest, shoulder, and abdominal muscles were all part of traditional physiotherapy. Diaphragmatic breathing, thoracic expansion exercises, and pursed-lip breathing were among the breathing techniques. For three months, the 30-minute sessions were conducted twice a day.

At baseline and three months later, outcome measures were evaluated. Primary outcomes included rib cage mobility measured by chest expansion using measuring tape and postural alignment assessed by plumb line and Cobb angle. Secondary outcomes included quality of life using the Ankylosing Spondylitis Quality of Life Questionnaire (ASQoL), functional disability using the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), pain using the Visual Analog Scale (VAS), and respiratory function using spirometry (FEV₁ and FVC). Blinded physiotherapists used standardized techniques to gather data. Daily activity records and twice-weekly supervised sessions were used to track exercise adherence. To ascertain the relative efficacy of the two therapies, all data were coded, safely preserved, and examined.

Results

The study comprised 60 individuals with Ankylosing Spondylitis who were split evenly between the experimental group (n = 30) and control group (n = 30). The average height was 167.33±6.62 cm, the average weight was 70.91 ± 7.03 kg, the average BMI was 25.34 ± 2.35 kg/m², and the average age was 46.16 ± 8.39 years. Males made up the majority of the study population (75%), which is in line with the higher incidence of Ankylosing Spondylitis in men. After the intervention, both groups exhibited improvement, however the experimental group that received both conventional physiotherapy and breathing exercises showed noticeably more improvements than the control group that received only conventional physiotherapy.

Both groups showed significant improvements in chest expansion at the xiphoid level, second intercostal space, and fourth intercostal space; the experimental group showed higher post-intervention values. The xiphoid level showed the biggest improvement (5.11 ± 0.47 cm in the experimental group vs. 4.01±0.34 cm in the control group). The experimental group showed considerable improvements in thoracic mobility, including flexion, extension, and lateral flexion, while the control group showed only slight changes, especially in lateral flexion, where improvement was not statistically significant. Both groups significantly improved in terms of postural alignment and spinal deformity as measured by the plumb line and Cobb's angle; however, the experimental group showed a larger decrease in postural misalignment and Cobb's angle than the control group.

Significant improvements were also seen in respiratory function. After breathing exercises, the experimental group's Forced Expiratory Volume in 1 second (FEV₁) and Forced Vital Capacity (FVC) increased more than the control groups, suggesting enhanced pulmonary function. Pain intensity measured using the Visual Analog Scale (VAS) showed a substantial reduction in the experimental group (from 8.47 ± 1.25 to 2.43 ± 1.10) compared to the control group (from 8.23±1.17 to 6.43±1.14). Both groups showed significant improvements in functional disability as measured by the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) and quality of life as measured by the Ankylosing Spondylitis Quality of Life Questionnaire (ASQoL), with the experimental group showing noticeably better results.

Overall, the results indicate that patients with ankylosing spondylitis benefit more from breathing exercises added to traditional physiotherapy than from traditional physiotherapy alone in terms of improved rib cage mobility, thoracic mobility, posture, respiratory function, pain, functional disability,

and quality of life.

Table 1. Post-Intervention Mean $\pm$ SD Values.

Outcome Measure	Control Group (Post-test Mean $\pm$ SD)	Experimental Group (Post-test Mean $\pm$ SD)
Chest Expansion – 2nd ICS (cm)	2.22 $\pm$ 0.47	2.53 $\pm$ 0.53
Chest Expansion – 4th ICS (cm)	2.74 $\pm$ 0.46	3.58 $\pm$ 0.39
Chest Expansion – Xiphoid Level (cm)	4.01 $\pm$ 0.34	5.11 $\pm$ 0.47
Thoracic Flexion	4.50 $\pm$ 0.90	6.17 $\pm$ 0.57
Thoracic Extension	3.53 $\pm$ 0.36	4.43 $\pm$ 0.32
Thoracic Lateral Flexion	14.25 $\pm$ 1.81	16.51 $\pm$ 1.02
Postural Alignment	1.77 $\pm$ 0.57	0.76 $\pm$ 0.25
Cobb's Angle ($^{\circ}$)	14.27 $\pm$ 2.74	12.47 $\pm$ 2.10
FEV ₁ (L)	3.31 $\pm$ 0.52	3.73 $\pm$ 0.47
FVC (L)	3.98 $\pm$ 0.67	4.64 $\pm$ 0.65

Discussion

The results of this study demonstrate the efficacy of including breathing exercises into traditional physical therapy for individuals with ankylosing spondylitis. Increased thoracic cage flexibility and improved respiratory muscle activation may be responsible for improvements in chest expansion and thoracic mobility. Improved muscular balance and posture correction methods may lead to better postural alignment and less spinal deformity. The results of the study are in line with earlier studies that indicate respiratory and physical therapy interventions together produce better functional results than physical therapy alone.

Conclusion

For individuals with ankylosing spondylitis, breathing exercises in conjunction with traditional physical treatment are more beneficial than traditional physical therapy alone in terms of improving rib cage mobility, respiratory function, posture, discomfort, and quality of life. To further validate these results, larger sample numbers, multicenter trials, and long-term follow-up should be incorporated into future research.

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