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Original Article

Physiotherapy Section

Effect of Egoscue Exercises versus Rigid Taping in Asymptomatic Individuals with Forward Head Posture: A Randomised Clinical Trial

PRIYANKA NAIK[1], SANTOSH METGUD[2]

ABSTRACT

Introduction: Forward Head Posture (FHP), commonly observed in both active and sedentary individuals, is associated with prolonged mobile phone use, poor ergonomic habits, and faulty postural alignment. This results in an altered Craniovertebral Angle (CVA) and muscle imbalance affecting daily functional activities. Egoscue exercises and rigid taping are recognised as effective interventions to address postural dysfunction; however, their comparative effectiveness in asymptomatic individuals remains underexplored.

Aim: To compare the effectiveness of Egoscue exercises and rigid taping on CVA and Pectoralis Minor Index (PMI) in asymptomatic individuals with FHP.

Materials and Methods: A randomised clinical trial was conducted at a tertiary healthcare centre in Belagavi, Karnataka, India, from November 2024 to April 2025. A total of 63 individuals aged 18-30 years were screened, of which 52 participants met the inclusion criteria and were randomly allocated into two groups (n=26 each). Group A received Egoscue exercises, while Group B received rigid taping along with conventional therapy. Outcome measures included CVA assessed using the Kinovea application and Pectoralis Minor Index (PMI), evaluated pre- and postintervention. Data were analysed using the Wilcoxon signed-rank test and Mann-Whitney U test (p-value <0.05).

Results: Baseline demographic characteristics showed comparable Body Mass Index (BMI) between Group A (22.27±4.45 kg/m²) and Group B (21.68±4.99 kg/m²), with similar gender distribution; however, mean age differed significantly between Group A (22.85±3.08 years) and Group B (26.00±4.63 years). Both groups demonstrated statistically significant improvements across all outcome measures (p-value<0.05). Between-group comparison revealed significant differences favouring Group B, with large to very large effect sizes for CVA (1.38), right PMI (0.99), and left PMI (1.48), indicating the efficacy of rigid taping.

Conclusion: Postintervention, rigid taping was associated with greater improvements than Egoscue exercises; however, interpretation of efficacy is limited by the baseline age difference, which may have influenced outcomes. Incorporating rigid taping into physiotherapy practice may enhance postural correction in individuals with FHP.

Keywords: Exercise therapy, Muscle imbalance, Posture, Range of motion

INTRODUCTION

The FHP is one of the most common sagittal plane deviations, increasingly prevalent among adolescents and young adults in modern society [1]. It is characterised by anterior displacement of the head relative to the trunk, resulting in altered biomechanics and increased mechanical load on the cervical spine [2]. Studies among university students aged 18-30 years report a prevalence of 60%–90%, highlighting its widespread occurrence [3,4]. Prolonged use of smartphones, laptops, computers, televisions, video games, and heavy backpacks has been identified as major contributing factors, gradually leading to FHP and kyphotic alignment [5].

Biomechanically, FHP is associated with muscular imbalance-tightness of cervical extensors (upper trapezius, levator scapulae, sternocleidomastoid, suboccipital muscles) and weakness of deep cervical flexors [6]. These changes reduce CVA, restrict cervical range of motion, and impair postural control. Sustained forward positioning increases gravitational stress on cervical structures, potentially causing cervical disc pathology, temporomandibular dysfunction, and chronic musculoskeletal pain [7-9]. FHP also affects the thoracic region and shoulder blades, contributing to broader musculoskeletal imbalance [10]. Frequently, it co-exists with upper crossed syndrome, characterised by thoracic kyphosis, rounded shoulders, and altered scapular kinematics, often linked to thoracic hyperkyphosis, inefficient muscle firing, or spinal malalignment [11,12]. Shortening of anterior musculature, particularly the pectoralis minor, further disrupts muscle length–tension relationships, influencing respiratory function and reducing functional efficiency [11,13].

Exercise therapy is a primary intervention for musculoskeletal disorders, incorporating mobilisation, stretching, strengthening, endurance, movement control, and proprioceptive training. For FHP, stretching cervical and pectoral muscles while strengthening deep cervical flexors and shoulder retractors helps restore alignment [6,14]. Global Postural Re-education (GPR) similarly emphasises neuromuscular re-education and sustained stretching [15]. Taping techniques, including kinesio and rigid taping, provide mechanical support, enhance proprioceptive feedback, and improve postural awareness [16]. Rigid taping may also reduce pain perception by stimulating cutaneous mechanoreceptors and improving tactile sensation [17]. Ergonomic modifications and posture education remain essential in addressing screen-related postural habits [3].

Egoscue exercises, designed to correct musculoskeletal dysfunction, aim to improve spinal alignment, joint mobility, stability, kinesthetic awareness, and muscle memory, thereby promoting postural balance [18,19]. According to Kendall's theory, corrective exercise lengthens shortened tissues and strengthens weak muscles to restore optimal alignment [17]. In contrast, rigid taping provides external support and sensory input that may influence muscle activation and joint positioning. While both interventions show benefits in managing postural dysfunctions, direct comparative evidence in asymptomatic individuals with FHP is limited. Some studies suggest rigid taping reduces pain and pressure sensitivity in latent trigger points among FHP patients [20]. Therefore, the present study aimed to compare the effects of Egoscue exercises and rigid taping in individuals with FHP.

MATERIALS AND METHODS

This randomised clinical trial was conducted at KLES Prabhakar Kore Hospital, Belagavi, Karnataka, India, between November 2024 and April 2025. Ethical clearance was obtained from the Institutional Research and Ethics Committee (Reference No. KIPT/884/23/11/2024), and the trial was registered with the Clinical Trial Registry of India (CTRI/2024/12/078132)

Inclusion criteria: Individuals aged 18-30 years, of both genders, clinically assessed with asymptomatic FHP were included in the study. Eligibility was confirmed when the CVA measured <50° using the Kinovea application [3,21].

Exclusion criteria: Prior shoulder complex fractures, hypersensitivity to adhesive tape, neurological deficits in the upper extremities, or thoracic/scapular surgeries were excluded from the study.

Sample size calculation: Sample size was estimated using hypothesis testing for two means, based on reduction in PMI between groups [15].

- Standard deviation (Group 1): 2.01
- Standard deviation (Group 2): 1.66
- Mean difference: 1.55
- Effect size: 0.847
- $\alpha = 0.05$, Power = 85%, two-sided

Corresponding Z-values were $Z1\text{-}\alpha = 1.96$ and $Z1\text{-}\beta = 1.037$, yielding a requirement of 26 participants per group (n = 52). To account for a 10% dropout rate, 63 individuals were screened. Of these, 52 met eligibility criteria and were randomised using a computer-generated sequence [Table/Fig-1] shows CONSORT flowchart. Recruitment was conducted through convenience sampling within the institute, with information disseminated by word-of-mouth. Screening included history, physical examination, and CVA assessment.

Participants were randomly allocated into two groups:

- **Group A (n = 26):** Egoscue exercises
- **Group B (n = 26):** Rigid taping

Baseline demographic and clinical data were recorded prior to intervention. Written informed consent was obtained from all participants.

Interventions

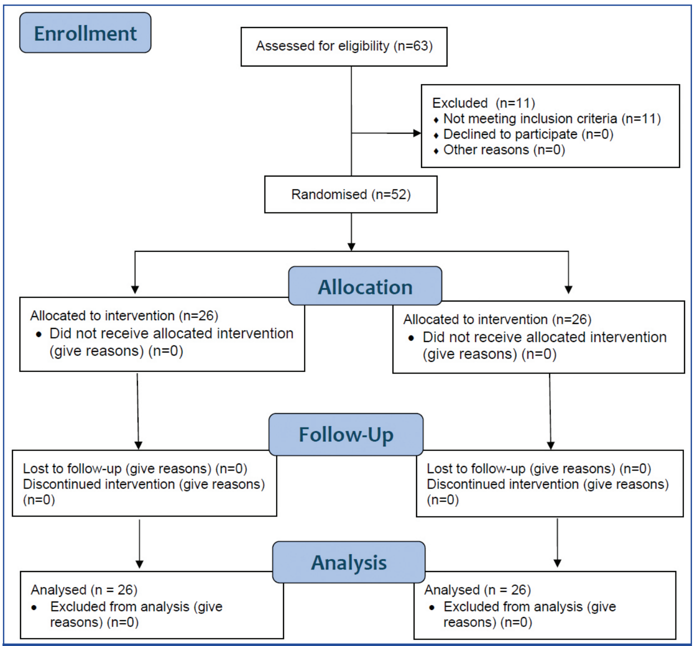
Group A- Egoscue Exercises (EE)

Participants performed four corrective exercises [Table/Fig-2] [15]:

- **Static back:** Supine, legs supported, arms at 45°, palms up. Hold 30 s [Table/Fig-2a].
- **Gravity drop:** Standing on box edge, knees straight, gravity-assisted alignment. Hold 30 s [Table/Fig-2b].
- **Static wall:** Supine, legs against wall, buttocks close, thigh contracted. Hold 30 s [Table/Fig-2c].
- **Sitting floor:** Sitting against wall, legs extended, scapulae retracted. Hold 30 s [Table/Fig-2d].

Progression: Alternate-day sessions, 3×/week for four weeks.

- Week 1: 3 reps × 30 s
- Week 2: 5 reps × 30 s
- Week 3: 15 reps × 30 s
- Week 4: 20 reps × 30 s



[Table/Fig-1]: Consolidated Standards Of Reporting Trials (CONSORT) diagram.

[Table/Fig-2a-d]: Static back, gravity drop, static wall and sitting floor.

Group B – Rigid Taping

Rigid zinc oxide tape (5 cm × 8 m) was applied with an underwrap from mid-clavicle to T8-T9. Participants maximally retracted scapulae during application. Tape was worn for 6-24 hours, reapplied every 48 hours, three times per week for four weeks [Table/Fig-3] [20].

Conventional Treatment (Both Groups): All participants received a Hot Moist Pack (HMP) for 15 minutes over the posterior cervical

[Table/Fig-3]: Rigid taping.

region and upper back, plus daily stretching and strengthening exercises for four weeks [13,14]:

- **Chin tuck:** Supine, head on floor, hold 6 s.
- **Shoulder retractor strengthening:** Standing, TheraBand scapular retraction, hold 6 s.
- **Sternocleidomastoid stretch:** Shoulder depressed, chin tuck, lateral flexion with rotation, hold 6 s.
- **Pectoralis stretch:** Standing, elbows flexed 90°, scapula squeezed against support, hold 6 s.

Outcome measures

Craniovertebral Angle (CVA): Reliability was established with intra- and inter-rater coefficients of 0.80. Photographs were taken using a mobile phone mounted on a tripod, 1.5 m from the seated subject at shoulder height. Landmarks (C7 spinous process and tragus) were marked, and CVA was calculated as the angle between a horizontal line through C7 and a line connecting C7 to the tragus. CVA values >50° were considered normative. Values between 30-50° indicated mild FHP, and values <30° indicated severe FHP [9,21].

Pectoralis Minor Index (PMI): Reliability was reported with ICC values of 0.82-0.87 and intraclass ICC of 0.96 [22]. Participants stood in relaxed posture. Landmarks (coracoid process and inferior border of the fourth rib at sternum) were palpated and marked. Distance was measured with a tape, normalised to height, and multiplied by 100 to calculate PMI. A PMI ≤7.65 cm indicated a shortened pectoralis minor [23].

STATISTICAL ANALYSIS

Data analysis was performed using the Statistical Package for Social Sciences (SPSS, version 23.0). Baseline demographic characteristics, including age and body mass index (BMI), were compared between groups using the Independent t-test, while gender distribution was analysed using the Chi-square test. Normality of the data was assessed with the Shapiro-Wilk test, which indicated non normal distribution. Accordingly, within-group comparisons between pre- and postintervention were conducted using the Wilcoxon signed-rank test, while between-group postintervention differences were evaluated using the Mann-Whitney U test. Outcome measures included CVA and PMI. All tests were two-tailed, with statistical significance set at p-value <0.05 and a 95% Confidence Interval (CI).

RESULTS

A total of 63 participants were screened, of whom 11 were excluded for not meeting inclusion criteria. The final sample comprised 52 individuals, randomised into Group A (Egoscue exercises, n=26; 13 males, 13 females) and Group B (rigid taping, n=26; 12 males, 14 females). The mean age was significantly lower in Group A (22.85±3.08 years) compared to Group B (26.00±4.63 years; p-value=0.0057). No significant differences were observed in BMI (22.27±4.45 vs 21.68±4.99 kg/m²; p-value=0.6522) or gender distribution [Table/Fig-4].

Variables	Group A (n=26)	Group B (n=26)	p-value
Age (years) (Mean±SD)	22.85±3.08	26.00±4.63	0.0057*
BMI (kg/m²) (Mean±SD)	22.27±4.45	21.68±4.99	0.6522
Gender (M/F)	13/13	12/14	-

[Table/Fig-4]: Comparison of demographic characteristics.
*Independent t-test and Chi-square test were used; p-value <0.05 was considered significant.

Both groups demonstrated significant improvements in CVA following intervention [Table/Fig-5]. Group A improved by 0.47° (p-value=0.0005), while Group B showed a larger gain of 1.48° (p-value=0.0001). Similarly, PMI improved significantly in both groups [Table/Fig-6]. Group A showed mean increases of 0.22 cm (right PMI, p-value=0.0014) and 0.23 cm (left PMI, p-value=0.0001). Group B demonstrated greater improvements of 0.55 cm (right PMI, p-value=0.0001) and 0.85 cm (left PMI, p-value=0.0001).

At baseline, no significant differences were observed between groups for CVA (p-value=0.9126) or PMI (right PMI p-value=0.0714; left PMI p-value=0.2722). Both groups showed significant within-group improvements in CVA. However, postintervention between-group differences in absolute CVA values were not statistically significant (p-value=0.1382; [Table/Fig-7]). The greater change scores observed in Group B (p-value=0.0001) indicate larger improvements relative to baseline, but superiority in CVA cannot be inferred from post-intervention values alone [Table/Fig-7]. For PMI, postintervention differences favoured Group B, with significant improvements in left PMI (p-value=0.0022) and highly significant overall changes in both right (p-value=0.0002) and left PMI (p-value=0.0001) [Table/Fig-8].

DISCUSSION

This study evaluated the effectiveness of Egoscue exercises and rigid taping in improving FHP among asymptomatic individuals. Both interventions produced significant improvements in postural alignment; however, rigid taping demonstrated comparatively greater gains in CVA and PMI.

Groups	Time	Mean±SD	Mean Diff.	SD Diff.	% of effect	Effect size	Z-value	p-value
Group A	Pretest	46.64±2.52	0.47	0.66	1.01	0.19	3.4557	0.0005*
	Post-test	47.11±2.58						
Group B	Pretest	46.23±3.46	1.48	0.80	3.19	0.43	4.3724	0.0001*
	Post-test	47.71±3.61						

[Table/Fig-5]: Intragroup comparison of CVA scores Group A and B.
Wilcoxon paired test applied for pre-versus post-comparison; p<0.05 is considered statistically significant.

Outcome variable	Groups	Time	Mean±SD	Mean Difference (MD)	SD difference	% of effect	Effect size	Z-value	p-value
Right PMI	Group A	Pretest	7.54±0.48	0.22	0.40	2.89	0.46	3.1936	0.0014*
		Post-test	7.76±0.64						
	Group B	Pretest	7.30±0.39	0.55	0.27	7.49	1.41	4.4573	0.0001*
		Post-test	7.85±0.47						
Left PMI	Group A	Pretest	7.51±0.71	0.23	0.28	3.03	0.32	3.9199	0.0001*
		Post-test	7.74±0.80						
	Group B	Pretest	7.78±0.80	0.85	0.56	10.09	1.06	4.9663	0.0001*
		Post-test	8.62±1.04						

[Table/Fig-6]: Comparison of right and left PMI within Group A and Group B.
*Wilcoxon paired test applied for pre-versus post-comparison; * p<0.05 is considered statistically significant.

Time	Group A		Group B		Effec t size	U-value	Z-value	p-value
	Mean±SD	Mean rank	Mean±SD	Mean rank				
Pretest	46.64±2.52	26.25	46.23±3.46	26.75	0.14	331.50	0.1098	0.9126
Post-test	47.11±2.58	23.37	47.71±3.61	29.63	0.19	256.50	1.4824	0.1382
Difference	0.47±0.66	17.77	1.48±0.80	35.23	1.38	111.00	4.1452	0.0001*

[Table/Fig-7]: Intergroup comparison of CVA between Group A and Group B.
Mann-Whitney U test. *p<0.05-statistically significant.

Outcome variable	Group A		Group B		Effect size	U-value	Z-value	p-value
	Mean±SD	Mean rank	Mean±SD	Mean rank				
Right PMI								
Pretest	7.54±0.48	30.31	7.30±0.39	22.69	0.55	239.00	1.8027	0.0714
Post-test	7.76±0.64	23.17	7.85±0.47	29.83	0.16	251.50	1.5739	0.1155
Difference	0.22±0.40	18.52	0.55±0.27	34.48	0.99	130.50	3.7883	0.0002*
Left PMI								
Pretest	7.51±0.71	24.17	7.78±0.80	28.83	-0.36	277.50	1.0981	0.2722
Post-test	7.74±0.80	20.06	8.62±1.04	32.94	0.96	170.50	3.0563	0.0022*
Difference	0.23±0.28	17.31	0.85±0.56	35.69	1.48	99.00	4.3648	0.0001*

[Table/Fig-8]: Intergroup comparison of right and left PMI between Group A and Group B.
Mann-Whitney U test. * p<0.05 - statistically significant.

Taping interventions have been reported to enhance proprioceptive input, improve muscle activation, and facilitate neuromuscular control, thereby contributing to postural correction [20]. Chamle S and Akhter Rizvi SR demonstrated that rounded shoulder posture is linked to abnormal scapular kinematics, muscular imbalance, and static contraction of cervical and shoulder muscles, which are biomechanically related to FHP. Prolonged trapezius shortening may further contribute to cervical abnormalities and restricted neck movements [24]. Similarly, Mosaad DM et al., highlighted that FHP and rounded shoulder posture are associated with altered cervical and thoracic alignment, abnormal scapular positioning, and dysfunction of the pectoralis minor muscle. These biomechanical changes explain the improvements in CVA and PMI observed in this study [25]. These findings support the superior outcomes seen with rigid taping compared to exercise-based intervention.

Corrective exercise approaches have also shown effectiveness in managing postural dysfunction. Egoscue exercises aim to restore alignment through neuromuscular re-education and correction of muscle imbalances [18]. Improvement in CVA reflects repositioning of the head towards neutral alignment, while changes in PMI indicate reduced anterior chest tightness and improved scapular positioning. Similar results have been reported in studies evaluating corrective exercise programs, where increased muscle flexibility contributes to better biomechanical alignment [15].

The mechanisms underlying these outcomes likely involve both neurophysiological and mechanical factors. Rigid taping provides continuous sensory stimulation, enhancing proprioceptive feedback and postural awareness, which facilitates immediate correction of faulty posture [26]. In contrast, exercise-based interventions promote gradual adaptation through restoration of muscle balance and improved motor control. These mechanisms explain the comparatively greater improvements observed in the rigid taping group.

Although both interventions were effective, the magnitude of CVA change was relatively small, and participants continued to exhibit features of FHP postintervention. Nevertheless, even modest improvements may reduce cumulative mechanical stress on cervical structures and help prevent progression of postural dysfunction. A previous study has also reported significant decreases in forward head angle and improvements in scapular upward rotation following rigid taping, supporting its corrective effect on cervical and scapular alignment [27].

A statistically significant baseline age difference was noted between groups, with Group B participants being older. Age-related changes in posture and muscle flexibility may have influenced responsiveness to corrective exercise, potentially acting as confounding factors [28]. Although change scores were used to minimise this effect, future studies should consider stratified randomisation or statistical adjustment methods such as ANCOVA.

From a clinical perspective, FHP is highly prevalent among young adults due to prolonged digital device use and sedentary lifestyles [3,4]. Interventions that produce even small improvements in alignment may reduce long-term musculoskeletal strain. The present findings suggest rigid taping may be beneficial for immediate correction and proprioceptive facilitation, whereas Egoscue exercises may support long-term improvement through neuromuscular adaptation. A combined approach could therefore optimise clinical outcomes.

A key strength of this study was the direct comparison of Egoscue exercises and rigid taping using both CVA and PMI, providing a comprehensive assessment of postural alignment and muscle length. Future research should include larger sample sizes, broader age ranges, gender-based analyses, and long-term follow-up. Incorporating objective tools such as radiographic evaluation, motion analysis systems, and functional outcome measures would further strengthen evidence and enhance clinical applicability.

Limitation(s)

The study was limited to participants aged 18-30 years, which may restrict generalisability. Gender distribution was not stratified, and potential gender-related differences in musculoskeletal characteristics and postural adaptation could influence outcomes. Additionally, long-term follow-up was not included, limiting assessment of sustainability, and functional outcomes such as quality of life were not measured.

CONCLUSION(S)

Both Egoscue exercises and rigid taping were effective in correcting FHP in asymptomatic individuals. However, rigid taping produced greater improvements in CVA and pectoralis minor flexibility. These findings support the use of rigid taping, postural correction and Egoscue exercises as an active approach for postural rehabilitation in physiotherapy practice.

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PARTICULARS OF CONTRIBUTORS:

1. Postgraduate Student (MPT), Department of Orthopaedic Manual Therapy, KLE Institute of Physiotherapy, Belagavi, Karnataka, India.
2. Vice Principal and Professor, Department of Orthopaedic Manual Therapy, KLE Institute of Physiotherapy, Belagavi, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Santosh Metgud,
KAHER Institute of Physiotherapy, JNMC Campus, Nehru Nagar, Belagavi-590010, Karnataka, India.
E-mail: santoshmetgud@klekipt.edu.in

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