

Effectiveness of Theraband Exercise verses Resisted Girdle Proprioceptive Neuromuscular Facilitation On Rounded Shoulder In Young Adults

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Abstract

Background: Rounded shoulder posture is increasingly prevalent among young adults due to prolonged sitting, excessive smartphone use, and muscular imbalance around the shoulder girdle. This postural deviation is commonly associated with tight pectoral muscles, weakened scapular stabilizers, altered scapular mechanics, and compromised upper-quarter function. Effective correction techniques are required to restore optimal alignment and prevent long-term musculoskeletal dysfunction.

Objectives: To compare the effectiveness of Theraband strengthening exercises and Resisted Girdle Proprioceptive Neuromuscular Facilitation (PNF) in improving rounded shoulder posture among young adults, using AT distance and scapular distance as quantitative outcome measures

Methodology: A total of 42 participants aged 18–24 years with rounded shoulder posture (AT distance ≥ 2.5 cm) were randomly allocated into two groups (n=21 each). Group A received Theraband exercises with pectoral stretching, while Group B received Resisted Girdle PNF with stretching. Both groups underwent 3 sessions per week for 4 weeks. Pre- and post-intervention values of AT distance and scapular distance were recorded and statistically analyzed.

Results: Both interventions produced statistically significant improvements within groups ($p < 0.0001$). However, between-group comparisons showed significantly greater improvement in the PNF group. The PNF group demonstrated a larger reduction in AT distance ($p = 0.016$) and showed significantly better postural correction after ANCOVA adjustment ($p = 0.0018$). Scapular distance also improved more in the PNF group compared to the Theraband group ($p = 0.005$). These findings indicate that Resisted Girdle PNF is more effective in restoring optimal scapular alignment and reducing rounded shoulder posture. Conclusion: Both Theraband exercises and Resisted Girdle PNF techniques are effective for improving rounded shoulder posture in young adults. However, Resisted Girdle PNF demonstrated significantly superior improvement, particularly in AT distance and scapular alignment effective therapeutic approach for correcting rounded shoulder posture in clinical populations

Key Words: Rounded shoulder, Theraband, Scapular PNF (proprioceptive neuromuscular facilitation), AT distance (acromion table distance)

1. INTRODUCTION:

Posture may be defined as —attitude of the body. Ideal posture is when the body parts, muscles and bones are aligned and work together in harmony, protecting the body from injury or progressive deformity, regardless of the attitude.¹ In particular, an inappropriate posture for a long time causes the centerline of the head to move forward and upward, which causes an increase in the weight of the head supported by the neck, ultimately resulting in changes in the head, neck and areas connecting the shoulders. Rounded shoulders is a typical bent posture in which the scapulae are elevated and the acromion is protruded forward in comparison with the center of gravity of body. There is increased protraction, upward rotation and anterior tilt of scapulae.² Rounded shoulders results from the shoulder being pulled forward by shortened or tight anterior shoulder girdle muscles, like pectoralis minor, pectoralis major and upper trapezius muscles. Subsequent increase in thoracic kyphosis will abduct the scapula, allowing for lengthening and weakness of rhomboids and lower trapezius.³ The presence of excessive and habitual flexion of the back leading to shortening of pectorals fixes the shoulder in forward position. The etiology of rounded shoulders has been attributed to several factors, posture and relative alignment of body segments are affected by muscle shortening and weakness. Muscles that become tight tend to pull the body segments to which they are attached, creating postural deviation. The prevalence of rounded shoulders is 84% in young adults (18 – 24 years of age).³⁻⁴ Resistive elastic materials, such as bands and tubes, are low-cost and highly versatile tools often used in therapeutic exercise programs.⁵ The Thera-band is elastic rubber band that can apply in any direction with resistance and it can control the speed and strength. Therefore, the Thera-band can apply a variety of resistance depending on the length, methods of grip, and color compared to weight-bearing exercise equipment such as dumbbells.⁶ effects of a resistance training program using an elastic band in young adults, and they found skeletal muscle adaptations following a short-term resistance training. However, weak muscles may find difficulty to perform resistance training using an elastic band, especially near the end of the range of motion, where the muscle is in a shortened position and the resistance of the material is greater.⁷ TheraBand has different color coding according to the level of resistance. Participants begun with the less resistive bands (e.g., yellow band) progressed to the higher resistance exercise band (e.g., red band).⁸ Proprioceptive neuromuscular facilitation (PNF) is a concept of treatment. Its underlying philosophy is that all human beings, including those with disabilities, have untapped existing potential (Kabat 1950). Proprioceptive – Having to do with any of the sensory receptors that give information concerning movement and position of the body Neuromuscular – Involving the nerves and the muscles Facilitation – Making easier.⁹ In the shoulder girdle, the scapula and clavicle work together as a unit. The scapula's primary support is muscles with only one attachment to the axial skeleton, at the manubrium. The shoulder girdle is dependent on muscular function and its ability to adjust to the underlying rib cage. In its normal function it is not a weight-bearing structure.⁹ The scapula patterns defined in PNF are activated within the upper extremity patterns and scapular motions together.¹⁰

2. LITERATURE REVIEW:

1. **Jangid et. al** Effect of elastic band exercises for rounded shoulders on chest expansion in young adults at the end of 6 weeks: An experimental study.”: An experimental study consisting of 60 subjects having rounded shoulders as per pectoralis minor length test and reduced chest expansion measured by non elastic tape within the age group of 18-24 years were selected. They were given elastic band exercises and stretching of the pectorals 3 times a week for 6 weeks and post treatment results were recorded. The findings of the study revealed a significant improvement in pre and post intervention chest expansion.³

2. **Iqra Altaf et.al (2023)** —Effects of Scapular Proprioceptive Neuromuscular Facilitation Technique on Scapular Dyskinesia A randomized clinical trial was conducted comprising of 26 patients. Patients were randomly allotted into 2 groups. Group A received scapular proprioceptive neuromuscular facilitation and Group B received conventional treatment group. Scapular dyskinesia was assessed through lateral scapular slide test. Visual Analogue Scale and Shoulder pain and Disability Index were used as outcome measures. The treatment was given for four weeks and there were 3 sessions per week. The data was collected at baseline and 4th week post treatment. The data was analyzed by using SPSS software version 23. study show that Significant improvement in VAS and SPADI was observed in scapular PNF group as compared to conventional treatment.²²

3. **Mosaad, Dalia et.al (2020)** Effect of forward head and rounded shoulder posture on hand grip strength in asymptomatic young adults: a cross-sectional study. Forward head and rounded shoulder posture (FHRSP) is a common clinical postural misalignment. It leads to flexion posture of the spine which increases the amount of tension on the nerve roots, which inversely affects muscle strength and function of the upper extremity. So, this study was conducted to examine the effect of FHRSP on hand grip strength in asymptomatic young adults and to explore the relationship between the craniovertebral angle (CVA) and hand grip strength. This study show that hand grip strength was not affected by FHRSP nor RSP in asymptomatic young adults. Moreover, the degree of the CVA was not associated with an inverse effect on hand grip strength.¹³

4. **Pulkit Walia et.al (march 2017)** The Effect of Forward Head Posture on Respiration, Cross-sectional study of 90 subject divided into three group 1 comprising 30 individuals with FHP between 1 to 2.5 cm (mild), Group 2 comprising of 30 individuals with FHP between 2.5 to 5 cm (moderate), Group 3 with 30 individuals with FHP more than 5 cm were taken outcome measure are respiratory rate, SPO2 chest expansion and the Spirometric parameters this study show that there was a significant impact of forward head posture on respiration^[1]

5. **Kim Tae-Woon et.al (2016)** Effects of elastic band exercise on subjects with rounded shoulder posture and forward head posture. Journal of physical therapy science This study evaluated the effectiveness of an elastic band exercise program in improving rounded shoulder posture and forward head posture among 12 participants. Pre- and post-intervention assessments included forward shoulder angle, craniovertebral angle, and muscle thickness measurements. The findings revealed significant improvements in pectoralis major length, forward shoulder angle, and craniovertebral angle, along with a significant increase in upper trapezius muscle thickness. The study concluded that elastic band exercises are beneficial for correcting postural deviations such as rounded shoulders and forward head posture.^[2]

6. **Kim et.al 2016** —Correlation between rounded shoulder posture, neck disability indices, and degree of forward head posture This study investigated the relationship between rounded shoulder posture, forward head posture, and neck disability in young adults aged 19–24 years. The degree of forward head posture was assessed using the craniovertebral angle in both standing and sitting positions, while rounded shoulder posture was measured in the supine position using Vernier calipers. Neck pain and functional disability were evaluated using the Neck Disability Index. The results showed a significant inverse relationship between the craniovertebral angle and neck disability scores in both standing and sitting postures. However, no significant association was found between forward head posture and rounded shoulder posture. The study concluded that increased forward head posture is associated with greater neck disability, but it does not necessarily result in rounded shoulder posture, highlighting the importance of maintaining proper posture to prevent postural pain and functional limitations^[12]

7. **Savadatti, et.al (2011)** —Effect of Forward Shoulder Posture on Forced Vital Capacity conducted a correlational study to examine the effect of forward shoulder posture on forced vital capacity (FVC). Forward shoulder posture alters thoracic alignment and respiratory muscle mechanics, which may negatively influence pulmonary function. Fifteen non-smoking male subjects with forward shoulder posture were assessed using interscapular distance and plumb line measurements, while FVC was measured using spirometry. The results showed a significant negative correlation between interscapular distance and FVC, as well as between plumb line deviation and FVC, indicating that increased severity of forward shoulder posture was associated with reduced lung capacity. The authors concluded that forward shoulder posture adversely affects respiratory function, emphasizing the importance of postural correction in improving pulmonary efficiency.¹⁶

3. AIM

To compare the effectiveness of Theraband exercises and resisted girdle proprioceptive neuromuscular facilitation (PNF) techniques in correcting rounded shoulders and improving postural alignment in young adults.

OBJECTIVES

To assess and compare the impact of theraband exercise group on strength and postural correction

To assess and compare the impact of resisted girdle pnf group on strength and postural correction

To determine which of the two techniques offers superior outcomes in reducing rounded shoulder

4. METHODOLOGY :

- Study design: comparative study
- Source of study: rounded shoulder
- Study setting: chh. Sambhajanagar city
- Duration of intervention : 4 week
- Sample method : Random sampling method
- Sample size: 42 participants (n=21 in each group)

For calculation of sample size for present study, G. Power software is used. Alpha = α = 0.05, Power = 0.80, Large effect size will be consider = 0.80. Using G*Power software sample size each group will be found to be 21 samples. So we will enrol 21 patients in each group.

INCLUSION CRITERIA

1. Both males and females are included.
2. Age between 18 to 24 year of age
3. Rounded shoulders: Distance between the couch and tip of shoulder >2.5 cm ^[2]
4. Muscle strength of upper limb and scapular muscles 3

EXCLUSION CRITERIA

1. Subject with rounded shoulder but do not fit in above age group
2. Any associated cardiopulmonary pathology (eg., Asthma, COPD)
3. Rib fracture
4. Scapula and upper limb fractures
5. Patients with other upper limb musculoskeletal disorders
6. Patients with cognitive impairments
7. Patient with visual and auditory deficits

MATERIAL REQUIRED

- Pen
- Data collection sheet
- Chair • Treatment table
- Measuring Tape
- Theraband latex free

OUTCOME MEASURE

Acromion to table test

was measured using the supine method. Participants were asked to lie in a supine position on a standard treatment plinth and assumed their natural relaxed posture with their arms on both sides and the elbows were flexed and rested against the lateral side of the abdomen

Then, the examiner measured the linear distance from the posterior aspect of the acromion process to the table by using a rigid plastic transparent right angle triangle.

If the distance was ≥ 2.5 cm, it means the participants have RSP Three measurements were registered; then, the average value was recorded¹²

Scapular distance

Normal in scapular resting position

the medial borders of the scapulae are parallel and the distance between these medial borders are 3-4 inches normally ¹³ Hoppenfeld suggested that the posterior midline of the body lies midway between the scapulae and that the medial borders are 5.08 cm (2 inches) from the spinous process and he added that the root of the spine of the scapulae is at the T3 vertebral level spinous process¹⁴.

According to David G Magee the normal adult inter scapular distance is 4 inches ¹⁵

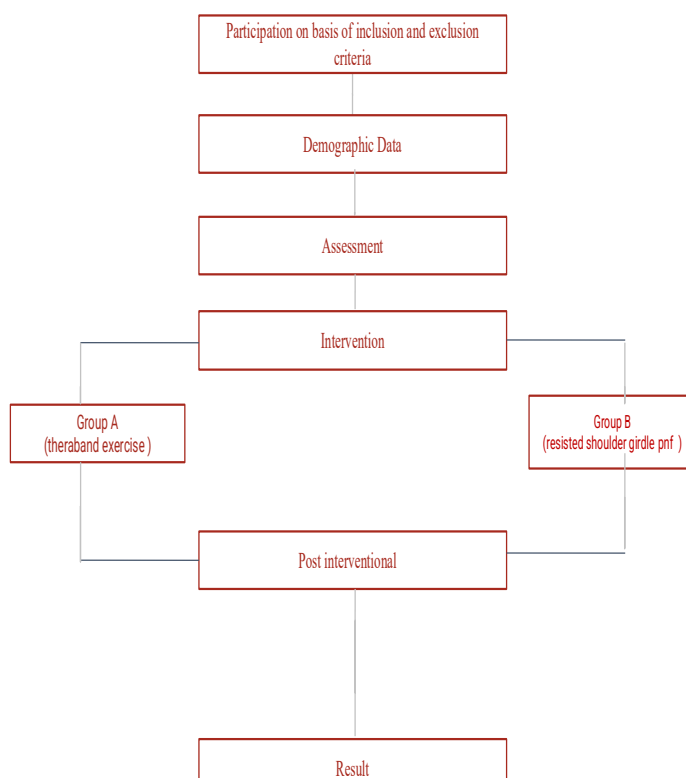


Fig 1

5. PROCEDURE

1. Ethical approval will be taken from concerned committee.
2. Subject will be explained about study.
3. A consent form will be taken.
4. Subject demographic data will be collected.
5. All the subjects in the study underwent a basic assessment for rounded shoulder posture i.e. measurement of rounded shoulder posture (AT distance), scapular distance

GROUP A:THERABAND

- Group A-Experimental Group (n=21) i.e. in theraband exercise for shoulder girdle with pectorals stretch
- Participants were selected according to inclusion and exclusion criteria and will be explained about the study.
- Consent form was taken from the participants.
- Pre intervention values of rounded shoulders recorded.
- Participants in this group received a 4-week, thrice-weekly⁸⁻³, 10 repetition of 3 set with 30 sec hold with pectorals stretch³
- As the exercises with resistive bands at one level became easier to perform, participants were asked to progress to the next level of exercise (exercise progression: RED band in the first two weeks and GREEN band in the last two weeks).
- Post intervention values of rounded shoulders were recorded

THERABAND EXERCISE

1. Scapular retraction
2. Shoulder horizontal abduction
3. Shoulder external rotation
4. Shoulder extension

Progression

RED theraband

First two week

Week 1 – 10 repetitions of 3 sets

Week 2 – 15 repetitions of 3 sets

At the end of the third week the subjects progressed to the next higher level of resistance

GREEN theraband

last two week

Week 3– 10 repetitions of 3 sets

Week 4 – 15 repetitions of 3 sets

With stretching of pectoralis minor and pectoralis major done 3 times with 30 seconds hold.

GROUP B

RESISTED GIRDLE PNF OF SHOULDER

Participants were positioned in side-lying on the unaffected side, with the therapist aligned along the direction of the intended movement. Preparatory instructions were provided prior to initiating each pattern.

The scapula was first guided into an elongated position before active movement was facilitated. Scapular PNF was administered using two diagonal patterns:

1. Anterior elevation and posterior depression

2. Posterior elevation and anterior depression

3 session per week for 4 week 20 repetition with 20 sec rest period in between ^[17]

With stretching of pectoralis minor and pectoralis major done 3 times with 30 seconds hold.

PNF Progression

First two (1 and 2)weeks active

last two (3and 4)weeks resisted.

Initial days 2 to 3 we will teach the participant the pattern then proceed to active for 2 weeks and resisted for 2 weeks

6. RESULTS :

Demographic Data A total of 42 participants were included in the study, with 21 participants in each group. Group A received Theraband exercises and Group B received Resisted Girdle PNF.

Table 1 shows the demographic distribution.

Variable	Group A (Theraband)	Group B (PNF)	Total
Sample size (n)	21	21	42
Age (Mean $\pm$ SD)	20.29 $\pm$ 1.90	23.29 $\pm$ 0.90	21.79 $\pm$ 2.11
Gender (M/F)	15 / 6	3 / 18	18 / 24

Table 1: Demographic characteristics of the study participants. This table represented the demographic characteristics of the study participants in both groups (Theraband and Resisted Girdle PNF). Variables such as age, gender distribution, height, and weight were recorded. Both groups consisted of 21 participants each, with comparable mean age and physical characteristics. The distribution indicated that participants were homogenous at baseline, and there were no significant differences between the groups. Hence, the groups were comparable for further analysis

Descriptive Statistics

Table 2 shows the mean and standard deviation for AT distance (Rounded Shoulder Assessment) for both groups.

Group	Pre-Test Mean $\pm$ SD (cm)	Post-Test Mean $\pm$ SD (cm)	Mean Difference (cm)	N
A	4.91 $\pm$ 0.87	4.13 $\pm$ 0.85	0.79	21
B	4.64 $\pm$ 1.05	3.54 $\pm$ 0.84	1.10	21

Table 2: Pre- and post-test AT distance values (mean $\pm$ SD) by group. This table presented the mean $\pm$ SD values of AT distance before and after intervention in both the Theraband and PNF groups. In the Theraband group, the mean AT distance showed a notable reduction from pre-test to post-test, indicating improvement in rounded shoulder posture. Similarly, the PNF group demonstrated a greater reduction in AT distance compared to the Theraband group. The paired t-test revealed that the reduction was statistically significant within both groups ($p < 0.05$), confirming that both interventions were effective in improving shoulder alignment

Figure 2 and Figure 3 show the mean pre- and post-test values for AT distance and scapular distance in both groups. Figure 16 shows the mean change comparison.

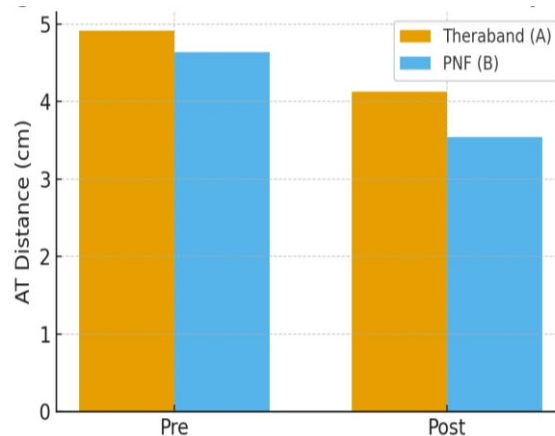


Figure 2 : Mean AT distance (Pre and Post) for Theraband and PNF groups.

This bar graph illustrated the mean changes in AT distance before and after intervention. Both groups demonstrated a reduction in AT distance after training, with the PNF group showing a slightly greater improvement compared to the Theraband group. The visual representation supported the statistical findings of Table.

Group	Pre-Test Mean $\pm$ SD (cm)	Post-Test Mean $\pm$ SD (cm)	Mean Difference (cm)	N
A	15.29 $\pm$ 0.34	14.60 $\pm$ 0.29	0.69	21
B	14.67 $\pm$ 0.48	14.16 $\pm$ 0.36	0.51	21

Table 3: Pre- and post-test Scapular distance values (mean $\pm$ SD) by group. This table displayed the mean $\pm$ SD values of scapular distance in both groups before and after intervention. The Theraband group showed a moderate decrease in scapular distance after exercise training, while the PNF group exhibited a more pronounced decrease. The within-group t-test showed that both reductions were statistically significant ($p < 0.05$), indicating that both interventions helped in restoring normal scapular positioning.

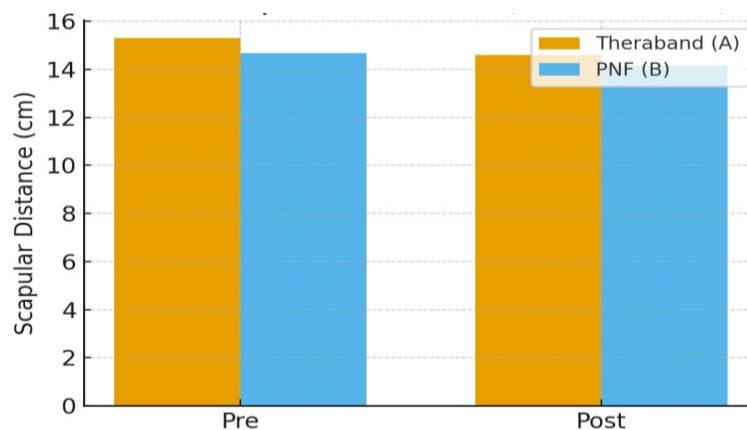


Figure 3 Mean Scapular distance (Pre and Post) for Theraband and PNF groups. This figure compared the mean scapular distance values before and after the interventions. A greater reduction was observed in the PNF group than in the Theraband group, reflecting better postural correction in scapular alignment.

Within-Group Comparisons

Paired t-tests were conducted to compare pre- and post-test scores within each group. Table 4 summarizes the results.

Group	Variable	Mean Difference (cm)	t-value	p-value	N
A	AT Distance	0.79	13.58	0.000	21
A	Scapular Distance	0.69	17.77	0.000	21
B	AT Distance	1.10	10.21	0.000	21
B	Scapular Distance	0.51	11.27	0.000	21

Table 4: Results of paired t-tests for pre- vs post-test comparisons within each group.

Between-Group Comparisons

Independent t-tests were performed on the change scores (pre - post) to compare improvements between groups. Table 5 summarizes these results.

Variable	Group A Mean Change (cm)	Group B Mean Change (cm)	t-value	p-value	95% CI for difference	N per group
AT Distance	0.79	1.10	-2.54	0.016	-0.55 to -0.07	21
Scapular Distance	0.69	0.51	2.96	0.005	0.06 to 0.29	21

Table 5: Between-group comparison of mean change scores (pre - post) This table compared the post-test mean AT distance and scapular distance between the two groups using an independent t-test. Results showed that the mean post-test AT distance in the PNF group was significantly lower than that of the Theraband group ($p < 0.05$). Similarly, the post-test scapular distance was also lower in the PNF group, indicating greater postural correction. These findings suggested that although both interventions were effective, the Resisted Girdle PNF technique produced a more significant improvement compared to the Theraband exercises.

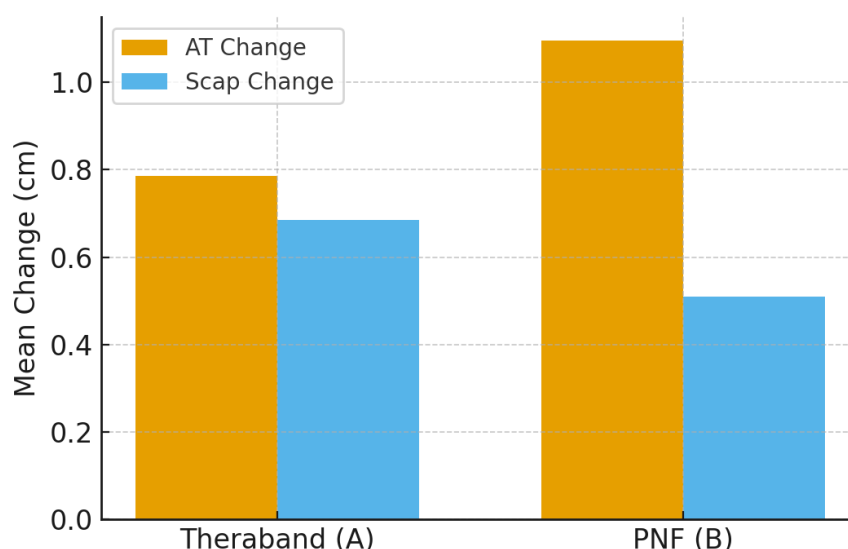


Figure 4 Mean change in AT and Scapular distance by group (Pre - Post). This figure graphically presented the adjusted post-test mean values of AT and scapular distance for both groups. The bars indicated that the PNF group had lower post-test values, confirming better alignment outcomes compared to the Theraband group

ANCOVA (Adjusted Comparison)

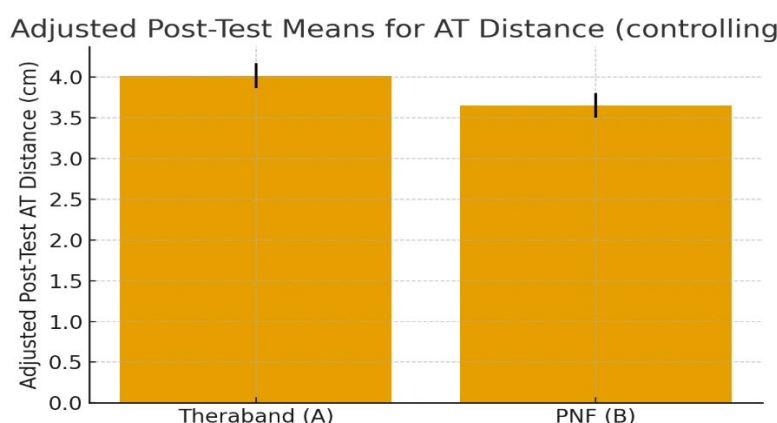
ANCOVA was conducted to compare the post-test AT distance between the Theraband exercise group (Group A) and the Resisted Girdle PNF group (Group B), while controlling for pre-test AT distance as a covariate. This method adjusts post-test means for baseline (pre-test) differences, thereby providing a more precise estimate of the intervention effect.

Table 6 ANCOVA Results for AT Distance (Post-Test adjusted for Pre-Test)

Source	Type II SS	df	Mean Square	F	p-value
C(Group cat)	1.3659	1	1.3659	11.202	0.0018
Pre AT mean	23.9185	1	23.9185	196.145	0.0000
Residual	4.7558	39	0.1219	—	nan

The ANCOVA revealed a statistically significant effect of group on post-test AT distance after controlling for pre-test AT ($F = 11.202$, $p = 0.0018$). Adjusted post-test means (estimated marginal means) at the overall mean pre-test AT: • Theraband (A): Adjusted mean = 4.018 cm (95% CI 3.863 to 4.173) • Resisted Girdle PNF (B): Adjusted mean = 3.653 cm (95% CI 3.498 to 3.808)

Figure : 5 Adjusted post-test means for AT distance (error bars = 95% CI)



Summary of Results Both intervention groups demonstrated statistically significant improvements in rounded shoulder posture and scapular alignment following the intervention period. Within-group analyses showed significant reductions in AT distance and scapular distance for both Theraband and PNF groups ($p < 0.05$). Between-group comparisons indicated that the PNF group had greater mean improvements in both AT distance and scapular distance compared to the Theraband group. ANCOVA adjusted comparisons confirmed a significant group effect for AT distance after controlling for baseline values

7. DISCUSSION :

The study aimed to comprehensively evaluate the effectiveness of Theraband strengthening and Resisted Girdle PNF in correcting rounded shoulder posture among young adults. A total of 42 participants completed the four-week intervention program, and both groups were comparable at baseline in demographic characteristics and initial postural deviation. Rounded shoulder posture was assessed using two validated quantitative outcome measures— Acromion-to-Table (AT) Distance and Scapular Distance—which reliably reflect anterior shoulder tightness and altered scapular positioning, as described by Borstad¹⁸ and Kibler¹⁹. Analysis of outcome revealed statistically significant improvements within both groups for both outcome measures. Group A (Theraband) showed notable improvement in AT distance (mean reduction 0.79 cm) and scapular distance (mean reduction 0.69 cm), suggesting that elastic resistance effectively strengthens the posterior shoulder musculature. Group B (PNF) showed even greater improvements in AT distance (mean reduction 1.10 cm) and scapular distance (mean reduction 0.51 cm). Between-group comparisons confirmed that PNF was significantly more effective, and ANCOVA further validated that PNF produced superior postural correction even after adjusting for baseline values. The study showed that both intervention groups demonstrated statistically significant reductions in AT distance after four weeks of training. This indicates that both Theraband strengthening and PNF were effective in reducing anterior shoulder tightness and improving forward

shoulder posture. Our study demonstrated that both Theraband strengthening and Resisted Girdle PNF significantly improved rounded shoulder posture, as shown by reductions in AT distance and scapular distance, with the Theraband group showing meaningful but comparatively smaller improvements. A similar pattern was observed in the study by Kim et al.², who reported that a structured elastic band exercise program produced significant reductions in forward shoulder angle and improved pectoralis major extensibility, thereby correcting rounded shoulder posture. Their findings emphasized that elastic resistance effectively enhances posterior shoulder activation and reduces anterior tightness. This directly supports the findings of our Theraband group, as the improvements observed in AT distance and scapular distance parallel the postural changes documented by Kim et al., confirming that elastic resistance exercises are effective in correcting rounded shoulder posture and validating the strengthening approach used in this study. The findings of this study showed that Theraband strengthening resulted in significant improvements in AT distance and scapular distance, indicating enhanced posterior shoulder muscle activation and reduction in anterior shoulder tightness. Simoneau et al.⁵ also demonstrated that elastic resistance elicits progressively increasing muscle activation throughout the entire range of motion, particularly in scapular stabilizers and posterior shoulder musculature. Their work highlighted that elastic bands effectively strengthen the muscles responsible for correcting rounded shoulder posture. This supports the results of our Theraband group, as the improvements observed can be attributed to the same progressive loading principles described by Simoneau et al.⁵ Both studies confirm that elastic resistance provides appropriate mechanical tension to strengthen scapular retractors, explaining the significant postural improvements seen in our participants. Although, study found that both interventions improved rounded shoulder posture, the PNF group demonstrated significantly greater reductions in AT distance and scapular distance compared to the Theraband group. This suggests that neuromuscular facilitation plays a key role in enhancing scapular mechanics. Ha et al.²⁰ similarly reported that scapular PNF patterns produced significantly higher EMG activation of serratus anterior and lower trapezius compared to isolated strengthening exercises. Their study concluded that PNF facilitates superior muscle recruitment and enhances coordinated scapular control. This strongly supports the findings of our PNF group, as the greater improvements observed in our study align with the enhanced neuromuscular activation described by Ha et al. The parallel outcomes confirm that PNF's ability to activate key stabilizers more effectively explains the superior postural correction seen in the present study. The study revealed that PNF training was more effective than Theraband strengthening in correcting rounded shoulder posture, with greater decreases in AT distance and scapular distance observed in the PNF group. These results are closely supported by Lee and Yoo²¹, who demonstrated that four weeks of scapular PNF exercises significantly improved forward shoulder posture, increased upward rotation, and restored balanced scapular movement. Their study concluded that PNF enhances coordinated muscle activation and corrects faulty postural patterns more effectively than conventional strengthening. This directly supports the superior outcomes of our PNF group, as similar improvements in shoulder alignment and scapular mechanics were observed, reinforcing that PNF offers greater neuromuscular benefits than isolated strengthening methods. In the present study, the PNF group showed significantly greater improvement than the Theraband group, particularly in scapular distance, demonstrating better scapular medialization and neuromuscular control. Altaf et al.¹⁷ reported comparable findings, showing that PNF-based scapular training resulted in greater improvements in scapular dyskinesis, serratus anterior activation, and coordinated scapulohumeral rhythm when compared with strengthening exercises. They concluded that PNF provides functional neuromuscular re-education beyond what isolated strengthening achieves. This directly supports our findings, as the enhanced scapular control observed in our PNF group is consistent with the superior motor coordination improvements documented by Altaf et al., validating the effectiveness of PNF for correcting scapular deviations. The result of this study demonstrated that the PNF intervention led to greater changes in scapular alignment and postural correction than Theraband strengthening. This is supported by Hwang²², who concluded that scapular stabilization PNF significantly improved scapular movement quality, scapular index, and posture in office workers with dyskinesis. Their findings highlight that PNF enhances proprioception and improves coordinated muscle firing patterns. This supports our study, as the superior improvements seen in the PNF group can be attributed to similar neuromuscular mechanisms described by Hwang, reinforcing PNF's role in improving functional scapular mechanics. These results indicate that while Theraband enhances muscular performance and posterior chain activation, PNF appears to target neuromuscular coordination more effectively, leading to greater functional correction of scapular mechanics. This shows PNF group has more significant improvement.

8. CONCLUSION :

This study was conducted to compare the effectiveness of Theraband strengthening exercises and Resisted Girdle Proprioceptive Neuromuscular Facilitation (PNF) in improving rounded shoulder posture among young adults. Both interventions demonstrated statistically significant improvements in Acromion-to-Table (AT) distance and Scapular Distance after four weeks of training, indicating effective correction of anterior shoulder tightness and improved scapular alignment. However, the Resisted Girdle PNF group showed significantly greater improvement in both

outcome measures compared to the Theraband group. ANCOVA analysis further confirmed that PNF remained superior even after adjusting for baseline values. These results suggest that while Theraband exercises enhance posterior muscular strength, PNF provides superior neuromuscular facilitation, coordinated muscle activation, and functional re-education of scapular mechanics. Thus, it can be concluded that both interventions are beneficial for correcting rounded shoulder posture, but Resisted Girdle PNF is more effective than Theraband strengthening in achieving optimal postural alignment and scapular control in young adults.

9. LIMITATIONS: The study was conducted on a small sample size, which may limit generalizability. The study duration was only four weeks, which may not reflect long-term outcomes or maintenance of postural correction. The participants belonged to a narrow age group (18–24 years), restricting applicability to older or clinical populations. Outcome measures were static assessments; dynamic scapular kinematics were not evaluated. No follow-up assessment was performed to determine the long-term retention of postural improvements. The study assumed that all participants had at least grade 3 muscle strength without formal MMT assessment. This limits the ability to evaluate individual baseline strength differences and to determine the extent to which improvements in postural alignment were influenced by changes in muscle strength

10.FUTURE RECOMMENDATIONS:

Future studies can evaluate the long-term effects of Theraband and PNF interventions through extended follow-up periods.

Larger sample sizes and multi-center trials can improve the external validity of the findings.

Advanced tools such as 3D motion analysis or EMG can be used to assess dynamic scapular movement patterns. Comparative studies involving other interventions such as kinesio-taping, manual therapy, or combined protocols may provide deeper clinical insights.

The effectiveness of these interventions can be explored in older adults, athletes, or individuals with symptomatic shoulder disorders.

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