

ORIGINAL ARTICLE

Effect of Interferential Therapy and Elastic Band Exercises on Subjects with Round Shoulder and Forward Head Posture: A Randomized Trial

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ABSTRACT

Objective: To investigate the effect of the Interferential therapy (IFT) with elastic band exercises to improve round shoulder posture (RSP) and forward head posture (FHP) in university female students.

Methods: A randomized trial was conducted at a state university in Haryana, India from July-October 2021. Females having FHP and RSP were included in the study. Subjects were divided into two groups. Group A performed elastic band exercises for 10 repetitions each twice weekly for four weeks along with IFT application for 10 minutes. While group B performed only elastic band exercises. Various Round Shoulder measurements, Craniovertebral angle (CVA) and Neck Disability Index (NDI) were assessed.

Results: Of 30 females, the mean age, weight, and BMI was 19.56 ± 3.14 years, 50.83 ± 9.13 Kg and 19.6 ± 3.23 Kg/m² respectively. The distance between 3rd thoracic vertebra (T₃) and acromion was significantly improved in group A as compared to group B, i.e., 2.80 ± 0.86 vs. -1.47 ± 1.98 (p-value 0.020), respectively. However, an insignificant association of group A and B was found with distance from couch to acromion (p-value 0.590), distance from thoracic 3rd level to inferior angle of scapula (p-value 0.630), CVA (p-value 0.130), and NDI (p-value 0.550).

Conclusion: Four weeks of intervention have significantly improved the distance between the T₃ and the acromion process parameters for both round shoulder and FHP in both groups. However, other parameters were not statistically improved but clinical improved in patients who received elastic band exercises combined with IFT.

Keywords: Forward Head Posture, Exercise, Interferential Therapy, Posture, Strength, Round Shoulder Posture

Clinical Trial Registry#: CTRI/2021/07/035111

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INTRODUCTION

Forward head posture (FHP) is commonly reported in all age groups of males and females. The normal craniovertebral angle (CVA) in males is 48.8 degree and in females is 47.6 degree.¹ Usually people involved in sedentary work like working on devices of any kind like computers and laptops complain of musculoskeletal pain particularly neck, shoulder, and back pain. Faulty work posture added with long hours of sedentary work can lead to strain in neck and eventually to shoulder region too with changes in muscles of the region.² Use of digital technology has considerably increased in COVID-19 pandemic and the lack of awareness about posture while using these devices is a major factor that leads to FHP or round shoulder posture (RSP).

This leads to increased stress on the biomechanical structures, muscle balance and altered alignment at shoulder too, which results in weak and shortened muscles of the shoulder joint. Shoulder and neck are

reported to be the most painful sites due to these faulty postures.^{3,4} With faulty postures the incidence rate of pain too increases from 11.5 to 29.⁴ Various factors like age, gender, physical activities, and occupation can also contribute to development of FHP.^{2,3,5,6} Similarly, factors which leads to RSP are characterized as protraction, downward rotation, and anterior tipping of scapula and this may increase upper thoracic kyphosis and cervical lordosis. These factors are the major predisposing factors which leads to upper quadrant pain too.⁷ Photographic posture analysis is a basic observational method to detect the FHP with reliability of >0.972.⁸ Interferential therapy (IFT) is an established therapy which is used to treat pain. This is also effective for providing relaxation of muscles and reducing pain.⁹ Addition of resistance exercises are used to strengthen the muscles using dumbbells, weight cuffs and resistance bands. These helps improve strength, flexibility, and also balance.¹⁰ With elastic band a postural program and a combination of strengthening

and stretching exercise could be used for correction of forward head. Resistance band helps in improving functional activities and also helps in improving strength, and balance control. These are also light in weight therefore, easy to carry too, hence can be used for normal individuals as well as for patients for strengthening muscles and training of various functional activities. Both elastic exercises and IFT have shown to be individually effective in correcting FHP and related musculoskeletal parameters. This study aims to find an affordable and quick acting protocol for improving the FHP and RSP by combined effect of exercises by elastic bands and IFT as compared to exercises alone.

METHODS

A randomised trial was done in which total 52 female subjects in the research university campus were initially screened, of which 30 subjects met the selection criteria. Trial was done till the required data was collected i.e., from July to October in 2021. Necessary ethical clearance for the study was taken from institutional ethical committee via letter No. PTY/2021/43, and the trial was registered with CTRI No. CTRI/2021/07/035111.

The study was conducted according to ethical standards of the Declaration of Helsinki, 2013. Subjects having rounded shoulder (a minimum distance from couch to acromion (cm) if more than 2.5 cm were considered for round shoulder^{7,11} and FHP i.e., CVA less than 50 were included in the study. Subjects who were not involved in any kind of regular physical activity, had any surgery in the last 6 months, any trauma, injury to clavicle and scapula or any other bone and ligament injury were excluded. The study included only female subjects. Females have shown to report more chances of neck pain as compared to men.^{12,13} Consenting subjects were divided into two groups; “A” exercise group that included 15 and “B” control group that also included 15 individuals. Simple lottery method was used to randomly assign the subjects to either group which was done by the department clinical therapist who was blind to the whole procedure. By this the total number of subjects calculated for the study was 30. Subjects performed one set of each exercise with 10 repetitions and IFT was applied for 10 minutes twice a week for 4 weeks. The variables for the study were: 1) Round Shoulder measurements a) Height of the acromion from couch, b) Distance between the third thoracic vertebra and the acromion, c) Distance between the third thoracic vertebra and the inferior angle of scapula

2) CVA 3) Neck Disability Index (NDI). All the measurements were taken on dominant side and were measured as follows- a) Height of acromion: Height of acromion was measured by the tape ruler. Subject was asked to be in supine lying position. First the acromion process on the dominant side was marked and the distance from acromion to couch was measured with a tape ruler. b) Distance between the third thoracic vertebra and the acromion: The patient was in prone position. T3 spinous process was palpated, and distance was measured from there up to the acromion process of the dominant side shoulder using a tape ruler. c) Distance between the third thoracic vertebra and the inferior angle of scapula: The patient was in prone position. After palpating the T3 spinous process and the inferior angle of the scapula both landmarks were marked properly and then the distance between the two points was measured with a tape ruler. 2) CVA Angle: During measurement of the CVA angle the patient was in standing position with neck in neutral, eyes facing straight. The C7 spinous level and the tragus of the ear were marked. A picture was taken using Redmi phone from 1.5 meters distance and further angle was measured by the “ANGULUS” app (Version 4.0) to measure the angle. The CVA is the angle made with the lines of a horizontal line of C7 and a line from tragus to spinous process of C7. For the CVA, the angle between the horizontal line and the line connecting C7 and the tragus was measured. 3) NDI score was measured using the standard NDI questionnaire which was filled by the subjects.

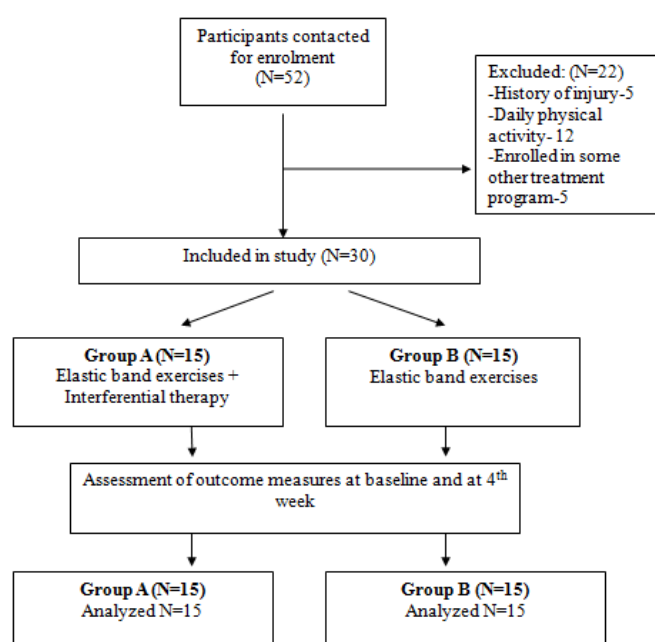


Figure 1 Shows flow of enrolment, allocation, follow up and analysis plan for the study

Intervention

The elastic band exercises were performed by the subjects with 10 repetitions each, twice a week for 4 weeks. The exercises included were 1) Lateral pull down- The subject held both ends of the elastic band while lifting the arms to shoulder width. Then stretched the band slowly in both directions and pulled it down to their chest. 2) Shoulder external rotation exercise- For the shoulder external rotation exercise, the subjects bent their arms to 90° and oriented their palms toward the ceiling, while their elbows at the height of the flank. Then held the elastic band and slowly stretched it while rotating their shoulders externally. They were instructed to not move the elbows forward. 3) Shoulder abduction exercise- For the shoulder abduction exercise, the subject stepped on the one end of the elastic band with the foot on the side being exercised, and another end held the elastic band with one hand and kept the hand low in its neutral position. Then instructed the subject to move away the shoulder with the elbows slightly bent. 4) Shoulder flexion exercise- For the shoulder flexion exercise, the subject stepped on the one end of the elastic band with the foot on the side being exercised, and another end of the elastic band held with one hand and kept the hand low in its neutral position. Then raise the arm forward with the elbow straightened. 5) Shoulder extension exercise- For the shoulder extension exercise, the examiner held one end of the elastic band, and the subject held another end. The subject started by holding the elastic band low in its neutral position, and then they extended the arm backward with the elbow straightened as much as possible.

For IFT application electrodes were placed on bilateral upper trapezius and levator scapulae muscles. It was applied twice a week for 4 weeks. Programme number 4 was used which is for cervical pain for 10 minutes with 52 beats frequency and intensity was chosen according to the tolerance power of individual subject with a comfortable tingling sensation.

Data entry and analysis were done using Statistical Package for Social Sciences (SPSS) version 21.0. Mean \pm SD were computed for quantitative variables like age, weight, BMI, distance from couch to acromion, distance from thoracic 3rd level to acromion process, distance from thoracic 3rd level to inferior angle of scapula, CVA, and NDI. Inferential statistics were explored using independent t-test and paired t-test to compare baseline data between patients with elastic band exercise alone or along with IFT. The p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Of 30 females the mean age, weight, and BMI of the study participants were 19.56 ± 3.14 years, 50.83 ± 9.13 kg and 19.6 ± 3.23 kg/m² respectively. At baseline height of group B patients was found significantly higher as compared to group A i.e., 163.60 ± 4.92 cm vs. 158.47 ± 4.45 cm (p-value < 0.001). While an insignificant association of group A and B was found with age (p-value 0.770), weight (p-value 0.920), BMI (p-value 0.260), distance from couch to acromion (p-value 0.570), distance from thoracic 3rd level to acromion process (p-value 0.600), distance from thoracic 3rd level to inferior angle of scapula (p-value 0.920), and CVA (p-value 0.080). (Table 1)

In Group A all the outcome measurements at 4th week were found statistically significant i.e., distance from couch to acromion (p-value < 0.001), distance from thoracic 3rd level to acromion process (p-value < 0.001), distance from thoracic 3rd level to inferior angle of scapula (p-value < 0.001), CVA (p-value < 0.001), and NDI (p-value < 0.001). While in group B which was taken at baseline and at the end of 4th week after giving the exercise protocol. In which the following outcome measurements, distance from couch to acromion (p-value < 0.001), distance from thoracic 3rd level to inferior angle of scapula (p-value < 0.001) and CVA (p-value < 0.001) at 4th week were found statistically significant. The variables of distance from thoracic 3rd level to acromion (p-value 0.120) and NDI (p-value 0.770) were found insignificant. (Table 2)

In table 3, between group comparison was done to evaluate for any differences between the mean difference of the study variables to assess the actual effect of the study intervention in each group. Mean difference of values was compared between groups which were taken at baseline and at 4 weeks of intervention. The distance between 3rd thoracic vertebra and acromion was significantly improved in group A 2.80 ± 0.86 as compared to group B -1.47 ± 1.98 (p-value = 0.020). An insignificant association of group A and B was found with distance from couch to acromion (p-value 0.590), distance from thoracic 3rd level to inferior angle of scapula (p-value 0.630), CVA (p-value 0.130), and NDI (p-value 0.550).

DISCUSSION

The findings of the current study reported that there were significant changes in FHP and RS parameters within both the groups of elastic band exercise and

Table 1: Comparison of baseline data between patients who underwent elastic band exercise alone or along with IFT (n=30)

Variables	Group A (n=15) Mean ±SD	Group B (n=15) Mean ±SD	95% C.I		p-value
			Upper	Lower	
Age (years)	20.60±4.18	18.53±0.74	4.31	0.18	0.770
Height (cm)	158.47±4.45	163.60±4.92	7.28	-6.61	<0.001*
Weight (kg)	51.0±10.44	50.66±7.98	-1.62	-8.64	0.920
BMI (kg/m2)	20.27±3.23	18.93±3.19	3.73	-1.06	0.260
Distance from couch to acromion (cm)	8.15 ± 1.69	8.50 ± 1.64	0.90	-1.59	0.570
Distance from thoracic 3 rd level to acromion process (cm)	20.58 ± 1.37	20.96 ± 2.53	1.13	-1.91	0.600
Distance from thoracic 3 rd level to inferior angle of scapula (cm)	17.54 ± 2.15	17.47 ± 1.92	1.59	-1.45	0.920
Craniovertebral angle (Degree)	45.54 ± 3.03	47.44 ± 2.72	0.24	-4.06	0.080

C.I: Confidence interval, IFT: Interferential therapy, Group A: Elastic band exercise + IFT, Group B: Elastic band exercise Independent t-test, *significant at p-value ≤0.05,

Table 2: Comparison of study variables between patients with elastic band exercise alone or along with IFT (n=30)

Variables	Group	Pre reading Mean ± SD	Post reading Mean ± SD	95% C.I		p-value
				Upper	Lower	
Distance from couch to acromion (cm)	A (n=15)	8.15± 1.69	5.94 ± 0.99	3.03	1.37	<0.001*
	B (n=15)	8.50± 1.64	6.52 ± 1.57	2.40	1.54	<0.001*
Distance from thoracic 3 rd level to acromion process(cm)	A (n=15)	20.58 ± 1.37	17.77 ± 1.48	3.28	2.32	<0.001*
	B (n=15)	20.96 ± 2.53	19.49 ± 2.55	2.57	-0.37	0.120
Distance from thoracic 3 rd level to inferior angle of scapula(cm)	A (n=15)	17.54 ± 2.15	15.42 ± 1.90	2.87	1.37	<0.001*
	B (n=15)	17.47 ± 1.92	15.55 ± 1.99	2.45	1.36	<0.001*
Cranio Vertebral angle (Degree)	A (n=15)	45.54 ± 3.03	51.46± 2.94	-4.68	-7.16	<0.001*
	B (n=15)	47.44 ± 2.72	51.81± 2.62	-2.58	-6.14	<0.001*
Neck Disability Index	A (n=15)	7.00± 3.16	6.00±2.61	1.46	0.53	<0.001*
	B (n=15)	7.00±5.63	6.26±4.23	1.91	-0.08	0.770

C.I: Confidence interval, IFT: Interferential therapy, Group A: Elastic band exercise + IFT, Group B: Elastic band exercise Paired t-test,*significant at p-value ≤0.05

Table 3. Comparison of effect of variables between patients with elastic band exercise alone or along with IFT (n=30)

Variables	Group A (n=15) Mean ± SD	Group B (n=15) Mean ± SD	95% C.I		p-value
			Upper	Lower	
Distance from couch to acromion (cm)	-2.20 ± 1.9	-1.97 ± 0.77	0.65	-1.12	0.590
Distance from thoracic 3 rd level to acromion process(cm)	2.80 ± 0.86	-1.47 ± 1.98	-1.87	-2.24	0.020*
Distance from thoracic 3 rd level to inferior angle of scapula(cm)	-2.12 ± 1.36	1.91 ± 0.98	0.67	-1.10	0.630
Cranio Vertebral angle (Degree)	5.92 ± 2.20	4.36 ± 3.21	3.63	-5.22	0.130
Neck Disability Index	-1.00 ± 0.84	0.73 ± 1.48	0.63	-1.18	0.550

C.I: Confidence interval, IFT: Interferential therapy, Group A: Elastic band exercise + IFT, Group B: Elastic band exercise Independent t-test, *significant at p-value ≤ 0.05

these exercises with IFT, while the distance from third thoracic spine to acromion was the only parameter that showed significant differences between the groups. However, all the parameters were better improved in group with IFT as compared to exercise alone, though all were not statistically significant.

The addition of IFT in group A could have led to the improved outcomes. Now along with the usual elastic band active exercises additional passive treatment like IFT application on select postural muscles could have helped in improving the posture. The nature of the intervention could also play a part in the outcome, as only active exercises have not always been shown to produce positive results.¹⁴ Application of IFT have also been reported to be quite effective in muscle relaxation and in reducing pain too.¹⁵

The findings of current study are supported in a study by Singh et al. done in 2021 in which effect of combining stretching and strengthening exercises of neck muscles in FHP among desk job operators was seen. The addition of stretching and strengthening exercises of neck muscles with IFT and hot packs showed significant improvement in FHP as against only IFT and hot pack group.¹⁶ In the present study too, within group comparison for all the variables in group A were found to be significant and in group B all other variables except distance from T3 spine level to acromion process (cm) and NDI were found to be significant. In both studies, addition of IFT with the exercises was effective in improving study parameters. This could be since IFT helps in improving neck pain and relaxing the

muscles and elastic band exercise helps in strengthening the weak muscles.¹⁵

According to another study of Choi et al., 2018 the author suggest IFT may be effective in correcting FHP. In this study all the study variables were improved clinically but not significantly. When between group comparison was done then no significant improvement was detected.⁹ However in the present study, when within group comparison was done, it showed that IFT application with TheraBand exercise was better as it may be helpful in improving the structural alignment by relaxing the muscles and also improved the various variables of round shoulder which in turn improved RSP as well as FHP. Further, when between group comparison was done, one outcome measure was significantly better improved i.e., distance from third thoracic vertebra to acromion process, while rest of all outcome measures were clinically improved. The difference between these two studies could be because of the duration of the study i.e., Choi et al., 2018 study was for 3 weeks, while in the present study treatment protocol was given for 4 weeks.⁹ This could have had better results in terms of improving the study variables too. However, they had given treatment thrice a week while the present study was for twice a week protocol. Since some patients might not be readily available for physical treatment or would not prefer to come frequently for treatments due to various reasons, the study protocol could be useful for such patients since it requires less sessions per week with clinical improvement in study parameters too.

The same effect was reported in another study by Pancholi et al., on FHP among dentists. Subjects who performed resistance band exercises as against conventional exercises showed significant improvement in pain, NDI and CVA angle at 10th week, while there were no significant changes up to 5th week in treatment group too.¹⁷

In present study too when we compared the pre & post data in both groups, the findings were statistically significant and improved in both the groups. This shows that the interventions are individually effective in treating the postural deviations. However, when we compared the mean differences between groups after 4 weeks, of all the study variables one variable showed significant changes i.e., distance from T3 to acromion process. It could be because the use of IFT in the present study could have helped in relaxing the middle trapezius muscle and TheraBand exercises in strengthening muscles particularly shoulder external rotation helps in improving abnormal postural deviations around shoulder that can lead to RSP. This could in turn help in correcting FHP too. So overall study findings shows that TheraBand exercise and IFT are more effective in treating RSP and FHP than any of these alone. It could be improved further using the different resistance bands according to the resistance level of the subjects.

Acedo et al., in a 2015 study showed that IFT gives better result rather than the Transcutaneous Electrical Nerve Stimulation in chronic nonspecific neck discomfort and pain by improving visual analog scale.¹⁹ It helps in muscle relaxation and also decrease pain. In another study, IFT is also believed to be a type of passive treatment, always given under observation.¹⁸ Our study results could have been due to similar reasons. IFT also helps in muscle relaxation and therefore could have been more effective in the intervention in group A. In previous studies subjects have performed active exercises without supervision¹⁹ while in present study, treatment was given under supervision. However, since only one outcome variable was significantly improved between groups, the results could have been better had the number of sessions or the study duration was prolonged. Future studies can be planned accordingly to see the effect of such variations on study parameters. Kim et al did a study in 2016 in which they saw the effect of resistance band exercise on subjects with RS and FHP. In this study author took 12 subjects having RS and FHP. Round shoulder and forward head postural measurements i.e., height of acromion to couch, distance from T3 to acromion, distance from third thoracic (T3) to inferior angle of scapula, distance

from third thoracic (T3) to inner surface of scapula, pectoralis major, rhomboid major and upper trapezius muscle length, CVA angle, cranio rotational angle were taken at baseline and after giving the intervention (Resistance band exercise with 15 repetitions /set, total 3 sets). Result showed that changes were only seen in pectoralis major muscle length, CVA angle which were significantly improved. Rest of the variables were not significantly improved.¹¹ Our study findings were similar, however, one variable i.e., distance from T3 to acromion process shows better results in group A as compared to group B, than the previous study. It could be more improved because with TheraBand exercises IFT was also given, and all exercises were done under guidance.

In the present study, only female subjects were taken which could be a study limitation. However, women are reported to have more neck pain as compared to males. Also, very few studies have been done exclusively on females^{20,21} and scarcely any reporting the effect of elastic band exercises and IFT on FHP and RSP. Number of sessions was also less, which could be increased more, or the total duration of protocol could be reduced and compared to see the effect. Larger study with a greater number of participants could be planned to see better generalization of results. For elastic band exercises a TheraBand of red colour was used. These bands come in different colours as per the varying resistance levels which could have been used for strengthening, to see the effects depending on the participants initial strength levels.

CONCLUSION

The elastic band exercise or TheraBand and IFT might be more effective in correcting round shoulder and FHP as compared to exercise alone in young sedentary people with postural abnormalities. Since IFT helps in improving pain and relaxing the muscles and TheraBand exercises helps in strengthening the weak muscles. However, all the study parameters were not statistically significant but clinical improvement was seen when application of elastic band exercise and IFT were applied together. It is pertinent to note that strengthening exercises with TheraBand and IFT definitely could have better effect in correcting FHP and Round shoulders. However, larger studies with diverse parameters, population groups and long follow up duration could be planned for better evaluation of the treatment effects on all the postural parameters.

ETHICAL APPROVAL: Ethical approval of this study was

obtained from the Ethic Committee of Guru Jambheshwar University Science & Technology, Hisar, Haryana, India (CTRI No. CTRI/2021/07/035111).

AUTHORS' CONTRIBUTION: SJ: Design, critical revision, final approval and interpretation. RK: Acquisition, analysis and drafting the manuscript. AP: Design, analysis, interpretation of data, drafting work, critical work, critical revision and final approval.

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