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# Comparison of Post Isometric Relaxation technique and Ischemic Compression technique on upper trapezius trigger points in high school girls with non specific neck pain: Randomized Clinical Trial

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## ABSTRACT

### Background

Neck pain contributes to be the second common musculoskeletal disorder in high school students. A significantly greater percentage of girls (21%) show symptoms during high school. Trigger points in upper fibres of trapezius muscle are present in those with cervical impairment. Hence, the study was conducted to compare the effects of post isometric relaxation technique and ischemic compression technique in the treatment of myofascial trigger points resulting in non specific neck pain in the high school girls.

### Methodology

A total of 80 subjects who fulfilled the inclusion criteria participated in the study. Selection of subjects in each group was done by randomization using random number table. Group A (40 subjects) received post isometric relaxation technique. Group B (40 subjects) received ischemic compression technique. Pain was graded on VAS and cervical side flexion (contralateral) range of motion (CROM) was measured using a full circle goniometer prior to treatment.

Tenderness of trigger point was assessed based on a simple tenderness scale· After a one week treatment, again the same outcome measures were measured for both the groups.

### Results

The data thus collected was subjected to statistical analysis.. Level of significance was kept at 5% (p value <0.05) was considered to be statistically significant. Wilcoxon Signed Rank Test was used for for intragroup comparison and Mann Whitney U test was used for inter group comparison.

The difference in mean values of pain on VAS was highly significant following treatment with post isometric relaxation technique (p value <0.0001) as well as with ischemic compression technique (p value <0.0001). The difference in the values of pain on VAS between both the groups was not found to be significant (p value 0.14).

The difference in mean values of cervical side flexion (contralateral) range of motion(CROM) was highly significant following treatment with post isometric relaxation technique(p value <0.0001) as well as with ischemic compression technique(p value <0.0001). The difference between both the groups was found to be highly significant (p value <0.0001), post isometric relaxation technique being more effective.

The difference in mean values of tenderness grading of trigger points was highly significant following treatment with post isometric relaxation technique(p value<0.0001) & with ischemic compression technique(p value <0.0001). The difference between both the groups was found to be significant (p value 0.007), ischemic compression technique being more effective

**Conclusion**

The study concludes that both the techniques were effective in reducing pain on VAS, increasing cervical side flexion (contralateral) range of motion and reducing tenderness of trigger point in high school girls with upper trapezius trigger points. On comparing the two groups, both the techniques were found to be equally effective in reducing non specific neck pain. Moreover, post isometric relaxation technique was found to be signicantly more effective than ischemic compression technique in improving cervical side flexion (contralateral) range of motion. Lastly, on simple tenderness scale, ischemic compression technique was found to be more effective than post isometric relaxation technique in reducing tenderness of upper trapezius trigger points.

**Keywords:** Trigger points, Trapezius, Neck pain, Post Isomteric Relaxation Technique, Ischemic Compression Technique, High School

## INTRODUCTION

Pain is an unpleasant sensory and emotional experience with actual or potential tissue damage. [1] Non specific neck pain, also called as 'mechanical' neck pain can be defined as simple neck pain without specific underlying disease causing the pain. [2, 3] It's lifetime prevalence is 45-54% in the general population out of which up to 30% of men and 50% of women experience neck pain throughout lifetime. [1, 4, 5]

Upper trapezius is a postural muscle and is highly susceptible to overuse. [6, 7] **Fernandez-de-las-Penas** found a relationship between the presence of trigger points in upper fibres of trapezius muscle and the presence of cervical impairment. [6, 7] **Simons et al** have claimed that myofascial trigger points from neck muscles might play an important role in the genesis of non-specific neck pain. [10] The extensive research suggests that upper trapezius muscle is the most commonly involved muscle for myofascial trigger points and the resultant non specific neck pain. [3, 11] Involvement of the trapezius muscle results in restriction of neck lateral flexion away from the involved side. [3, 11]

Epidemiological studies suggest that myofascial pain syndrome, a complex pain disorder characterized by a steady dull ache referring to a specific reference zone from a myofascial trigger point within a palpable band of muscle as one of the commonest causes of neck pain. [2, 12] A myofascial trigger point is a hyper irritable spot, located within a taut band of a skeletal muscle that is painful on compression or stretch and that can give rise to a typical referred pain pattern as well as an autonomic phenomena. [8, 13] Myofascial trigger points are clinically classified as latent and active. Latent ones are more prevalent than the active ones. [11, 14]

**Sari Siivola et al** stated the prevalence of self-reported weekly non specific neck pain in 15 to18 year old adolescents to be 17%, and in seven years, the prevalence of weekly non specific neck pain had increased to 28%. A significantly greater percentage of girls (21%) than boys (11%) had weekly symptoms and the girls' neck and shoulder symptoms increased during high school. Female gender, hobbies which statically load the upper extremities, low intensity of physical exercise were associated with a high prevalence of non specific neck pain. [15] **Zamani et al** stated that non specific neck pain due to the presence of upper trapezius trigger points is more prevalent in women than men. [11] **Ghazala et al** suggested that school bag load and classroom furniture played a major role in prevalence of musculoskeletal disorders of which neck pain contributes 38.6%. Moreover, intensity of schoolbag stress impact is comparatively higher as girl child because of the body structural differences. [17] Research says that the injured fibers receive less oxygen and blood supply resulting in less removal of metabolic waste and supply of nutrients to muscle fibres. This forms trigger points in the muscle's fibres, close to the motor end plate (neuromuscular junction) causing hyperalgesia that limits ranges of neck and restricts activities of daily life. [18, 19] Taut band, spot

tenderness, local twitch response, referred pain pattern, jump sign, and restricted range of motion are the most common physical diagnostic features of myofascial trigger point. [20]

The treatment of latent myofascial trigger point includes both invasive and non-invasive techniques. Despite the abundance of MTP treatment techniques, manual therapy remains one of the main approaches showing a key role of the physical therapist in the treatment of MTrp. [2, 4, 6, 7, 20, 21]

Post isometric relaxation technique, a type of muscle energy technique involves the introduction of an isometric contraction to the affected muscle producing post isometric relaxation through the influence of the Golgi tendon organs (autogenic inhibition). [8, 15, 22, 23, 24]

Ischemic compression, a manual therapy technique involves applying direct sustained digital pressure to the myofascial trigger point with sufficient force over dedicated time duration, to slow down the blood supply and relieve the muscle tension, thereby resulting in reactive hyperaemia. [5, 19, 24, 25]

Though it is evident from literature that both the techniques are effective in the treatment of myofascial trigger points, we have come across limited amount of research to support which technique gives better results in adolescent girls with non specific neck pain.

## Aim

To compare the effectiveness of post isometric relaxation technique and ischemic compression technique on upper trapezius trigger points in high school girls with non specific neck pain.

## Objectives

1. To analyze the effectiveness of post isometric relaxation technique on upper trapezius trigger points in high school girls with non specific neck pain
2. To analyze the effectiveness of ischemic compression technique on upper trapezius trigger points in high school girls with non specific neck pain
3. To compare the effectiveness of post isometric relaxation technique and ischemic compression technique on upper trapezius trigger points in high school girls with non specific neck pain

## Materials and methodology

Permission and approval to carry out the research work was obtained from Head Of Institution and Institutional Ethical Committee.

**Study design:** Randomized Clinical Trial

**Study set up**: High School

## Selection criteria

## Inclusion criteria

- High school girls between age group 14-18 years with non specific neck pain for less than 3 months. [7]
- Unilateral side pain [30]
- Local pain more than 3 cm on visual analogue scale [7, 11]
- The presence of latent MTrPs on upper trapezius which was determined using the diagnostic criteria as described by Simons et al [10, 11]
- Participants with palpable and painful upper trapezius trigger point of grade 2 and/or grade 3
- The lateral flexion ROM of the side contralateral to presence of TrP should be decreased than ipsilateral side. [2,7, 30]

## Exclusion criteria

- Participants with any specific causes of neck pain like trauma, prolapse of intervertebral disc, with shoulder joint pathology, neurological deficits involving upper limb, clotting disorders, malignancies. [11]
- Skin condition or open wound over upper trapezius region[2]
- Cognitive Dysfunction [3]
- Congenital problems like torticollis[2]
- History of recent surgery in the neck region
- Fibromyalgia[11]
- Those undergoing any other medical treatment for the same cause.[11]

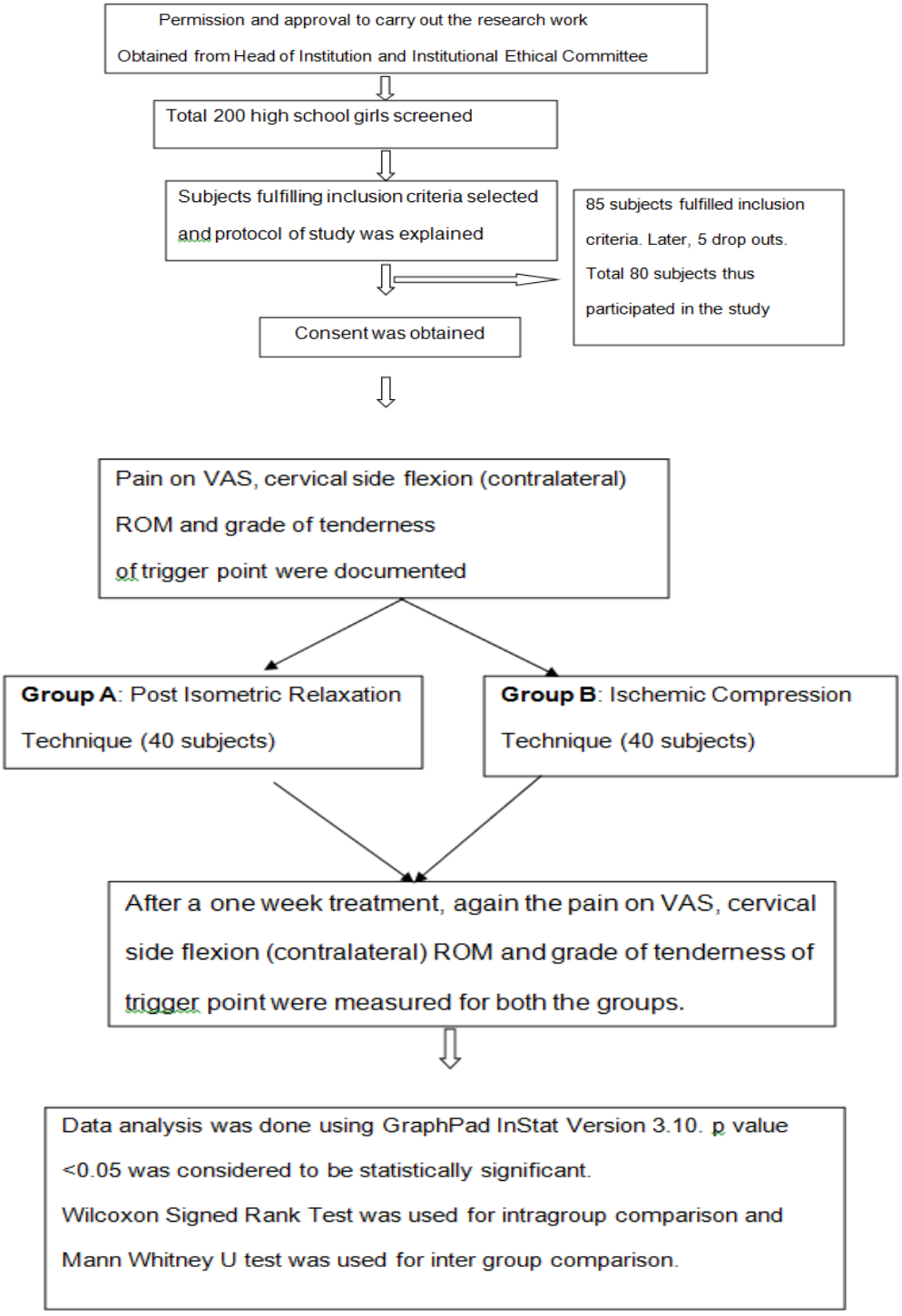
## Sample size

Sample size was calculated on the basis of previous published study assuming confidence interval 95%, mean and standard deviation values.[9] Estimated sample size was 80 subjects, i.e.,40 in each group (www.openepi.com version3).

## Materials required

- Full circle goniometer
- Treatment table
- Chair Pen
- Paper
- Visual Analog Scale(VAS)
- Lubricant (powder)

## FLOWCHART (METHODOLOGY)



### For Group A (Post Isometric Relaxation technique)

The subjects were positioned in supine. The shoulder on the affected side was stabilized while the mastoid area of the affected side was held by opposite hand with one hand. Then, the head and neck were side bent towards the contralateral side, flexed, and rotated ipsilaterally, placing the subject just short of their upper trapezius restriction barrier. The subjects were then instructed to shrug the involved/stabilized shoulder toward the ear at a submaximal, pain- free effort (20% of their available strength). The isometric effort was held for 7- 10 seconds maintaining a normal breathing rhythm. After the effort, the subjects were asked to relax and let go completely and then muscle was taken to the new barrier, each stretch being held for 30 seconds. Starting from that new barrier, the procedure was repeated for five times for three sessions (on alternate days) for one week. [2, 8, 25]

Post Isometric Relaxation Technique

### For Group B (Ischemic Compression technique)

The subjects were evaluated for areas of restriction. The treatment area was cleaned with water using cotton and the area was dried before applying the technique. Later, powder was applied on to the treatment area in order to reduce friction thereby, preventing blister formation. The subjects were placed supine on the couch with the head fully on the surface of the couch, to reduce tension in the upper trapezius muscle. Arm was positioned in slight shoulder abduction with the elbow bent and their hand resting on their stomach. To perform this ischemic compression to the upper trapezius, therapist standing behind the subject utilized a pincer grasp placing the thumb and index finger over the trigger point. Slow, increasing levels of pressure were applied until the tissue resistance barrier was identified. A sustained pressure was then applied for 90seconds. Pressure was then released when a decreased tension in trigger point was noted or when trigger point was no longer tender or 90 seconds had elapsed, whichever occurred first. The technique was applied within the limits of tolerable pain. Then, the stretches were performed for the trapezius muscle and holding each stretch for 30 seconds. The same sequence of ischemic compression was repeated for five times for three sessions (on alternate days) for one week. [2, 5, 8, 12, 20, 21, 33]

Following each intervention, both groups received isometric neck exercises and upper trapezius stretching exercises on alternate days for one week.

### Outcome measures

These parameters were taken pre-treatment on 1st day and post-treatment on 7th day

1. Pain on Visual Analog Scale (VAS)
2. Cervical side flexion (contralateral) Range Of Motion(CROM) using a full circle goniometer
3. Tenderness of trigger point assessed based on a simple tenderness scale[40],

- Grade 0: No tenderness
- Grade 1 : Tenderness to palpation without grimace or flinch
- Grade 2 : Tenderness with grimace and/or flinch to palpation
- Grade 3 : Tenderness with withdrawal (positive "jump sign")
- Grade 4 : Withdrawal (positive "jump sign") to non noxious stimuli (i.e., superficial palpation, pin prick, gentle percussion)

## STATISTICAL ANALYSIS

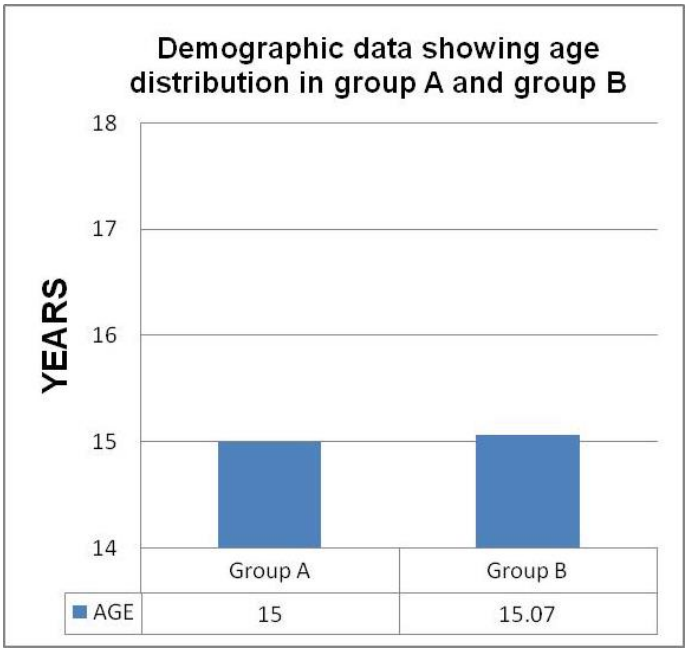
The data thus collected was subjected to statistical analysis using software GraphPad InStat Version 3.10. Descriptive statistics like mean, standard deviation and mean difference were used for data presentation and analysis. Level of significance for whole statistical analysis was kept at 5% i.e, a p value <0.05 was considered to be statistically significant. The data was subjected to normality testing. It was not found to be normally distributed, so Wilcoxon Signed Rank Test was used for for intragroup comparison and Mann Whitney U test was used for inter group comparison

## RESULTS

Statistical software GraphPad InStat Version 3.10 was used for data analysis.

**Table No. 1: Demographic data showing age distribution**

| | Group A (n= 40) | Group B (n=40) |
|---|---|---|
| | Mean ± SD | Mean ± SD |
| AGE | 15±0.67 | 15.07±0.94 |

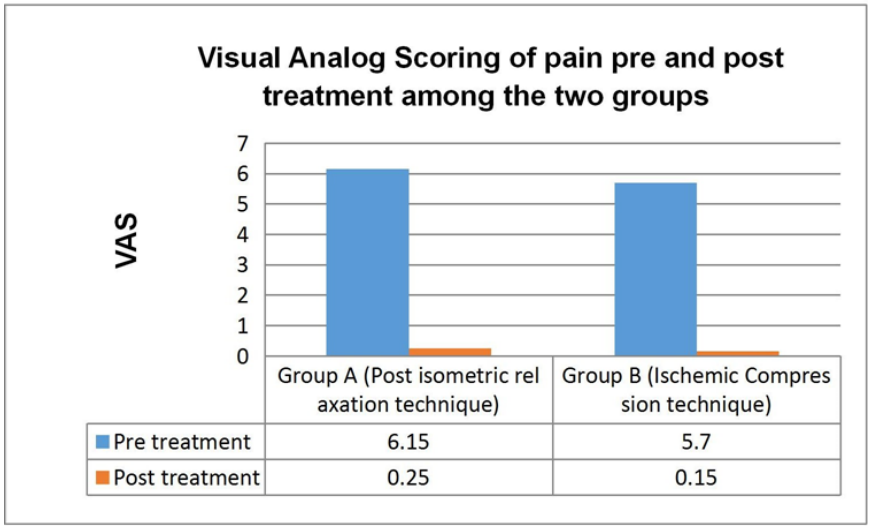


## Interpretation

The mean values of age in both the group were comparable. Also, both the groups had high school girls. So, gender was also comparable in both the groups.

**Table No.2: Intra group analysis of VAS among two treatment groups**

| VAS | GROUP A (Post Isometric Relaxation Technique) | GROUP B (Ischemic Compression Technique) |
|---|---|---|
| | Mean ± SD | Mean ± SD |
| Pre treatment | 6.15±0.89 | 5.70±0.96 |
| Post treatment | 0.25±0.49 | 0.15±0.36 |
| p value | <0.0001****, Highly Significant | <0.0001****, Highly Significant |



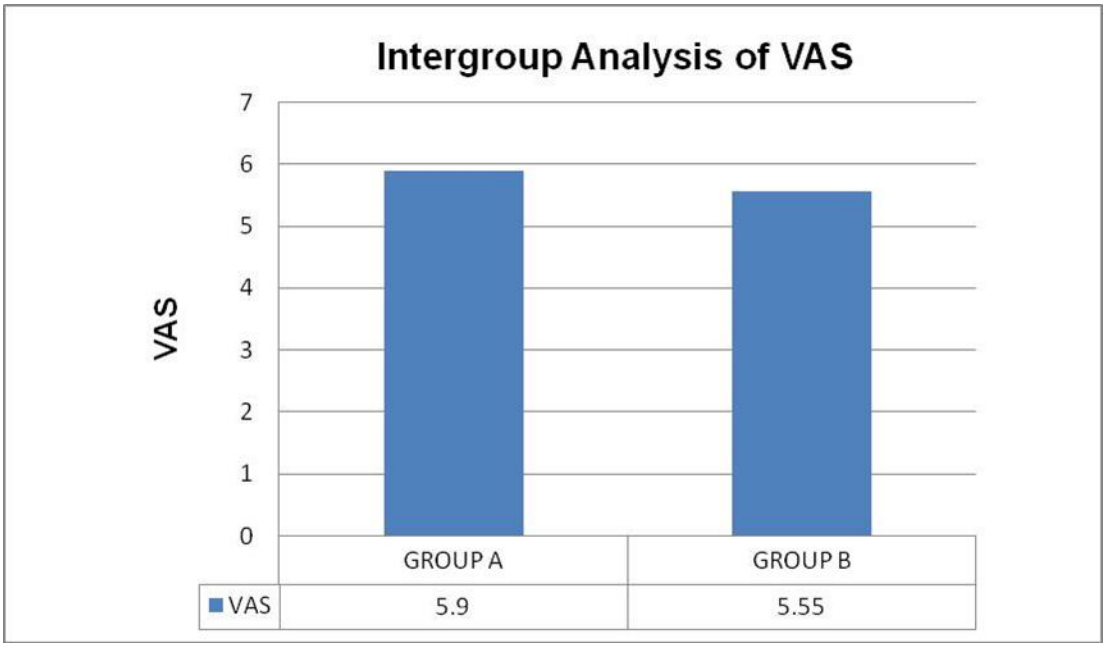

## Interpretation

The mean value of pain on VAS pre treatment (6.15±0.89) was reduced post treatment (0.25±0.49). The difference was highly significant (p value <0.0001) following treatment with post isometric relaxation technique (Group A)

The mean value of pain on VAS pre treatment (5.70±0.96) was reduced post treatment (0.15±0.36). The difference was highly significant (p value <0.0001) following treatment with ischemic compression technique (Group B)

**Table No.3: Intergroup analysis of pain on VAS between Group A and Group B**

| VAS | GROUP A (Post Isometric Relaxation Technique) | GROUP B (Ischemic Compression Technique) | p value |
|---|---|---|---|
| Mean difference | 5.90±1.05 | 5.55±1.06 | 0.14, Not Significant |

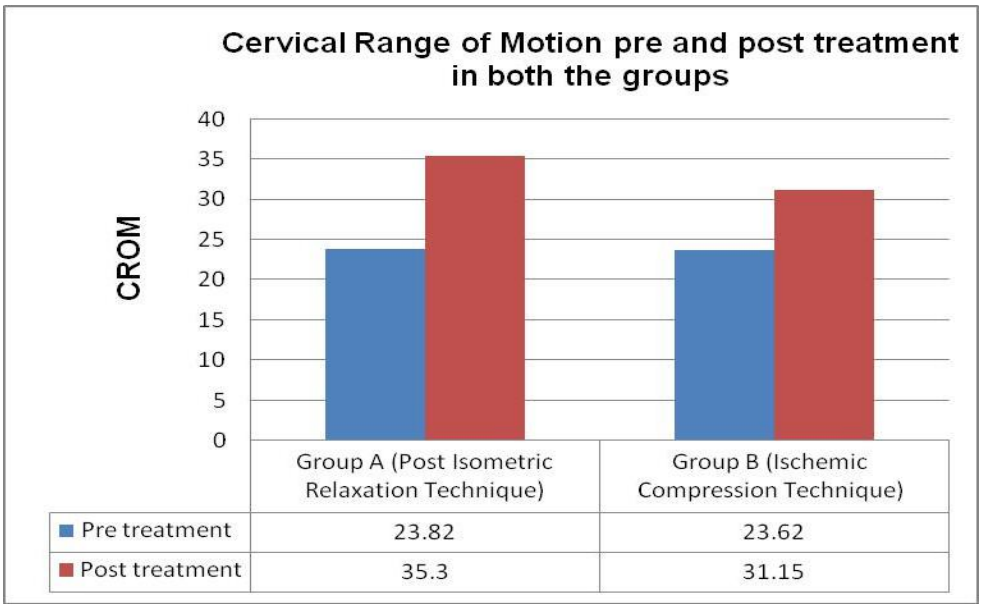



## Interpretation

The mean difference value of pain on VAS in group A (5.90±1.05) was almost equivalent to that in group B (5.55±1.06). The difference between both the groups was not found to be significant (p value 0.14)

**Table No.4: Intra group analysis of Cervical side flexion (contralateral) Range of Motion (CROM) among two treatment groups**

| CROM | GROUP A (Post Isometric Relaxation Technique) | GROUP B (Ischemic Compression Technique) |
|---|---|---|
| | Mean ± SD | Mean ± SD |
| Pre treatment | 23.82± 2.35 | 23.62±1.80 |
| Post treatment | 35.30±2.66 | 31.15±2.53 |
| p value | <0.0001****, Highly Significant | <0.0001****, Highly Significant |



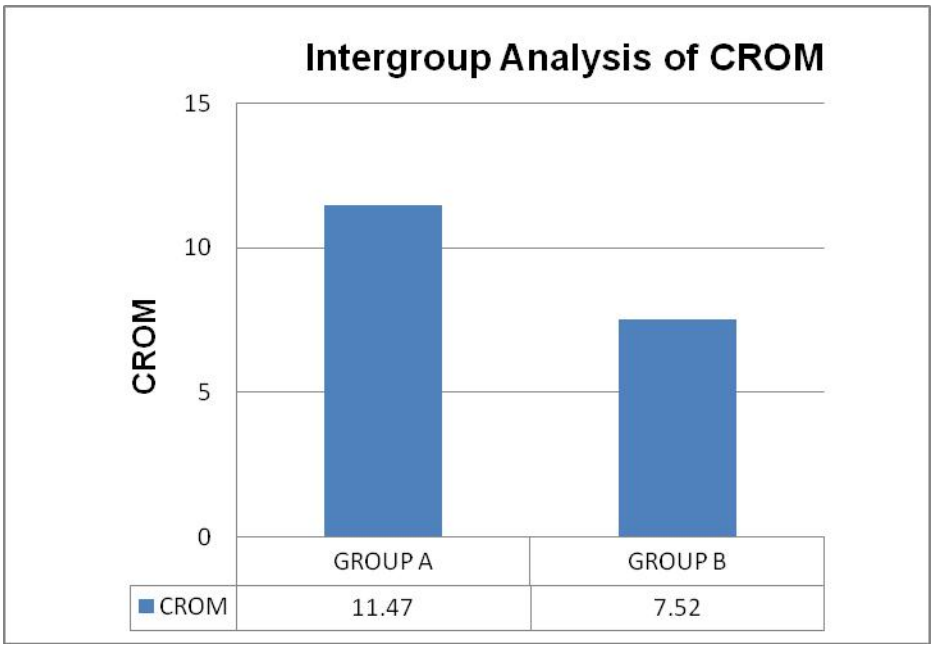

## Interpretation

The mean value of cervical side flexion (contralateral) range of motion (CROM) pre treatment(23.82±2.35) was increased post treatment(35.30±2.66). The difference was highly significant (p value <0.0001) following treatment with post isometric relaxation technique (Group A)

The mean value of cervical side flexion (contralateral) range of motion (CROM) pre treatment (23.62±1.80) was increased post treatment(31.15±2.53). The difference was highly significant (p value <0.0001) following treatment with ischemic compression technique (Group B)

**Table No.5: Intergroup analysis of cervical side flexion (contralateral) range of motion (CROM) between Group A and Group B**

| CROM | GROUP A (Post Isometric Relaxation Technique) | GROUP B (Ischemic Compression Technique) | p value |
|---|---|---|---|
| Mean difference | 11.47±3.07 | 7.52±1.92 | <0.0001****, Highly Significant |

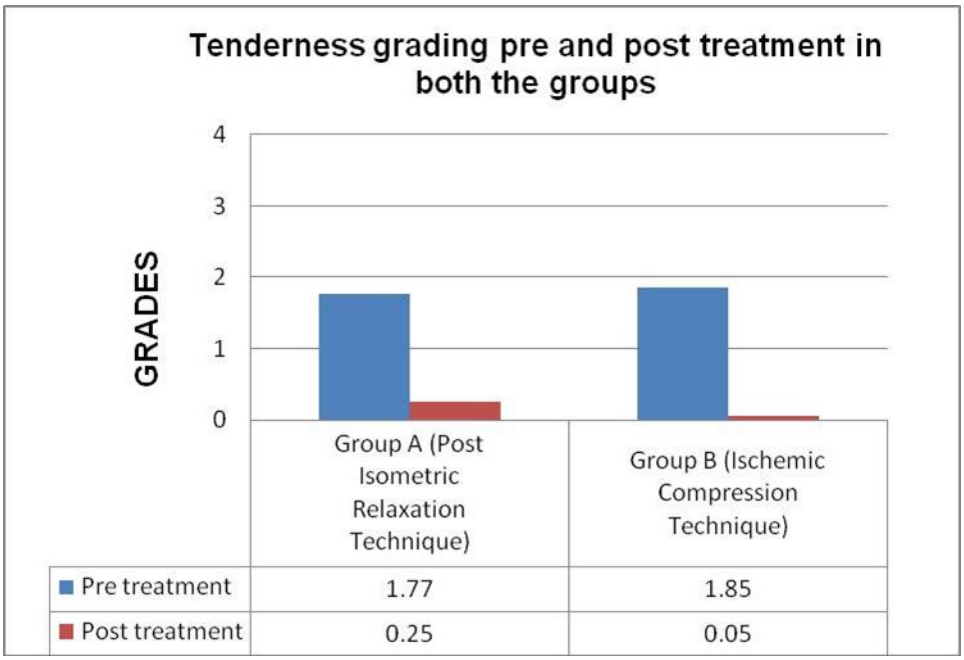



## Interpretation

The mean difference value of cervical side flexion (contralateral) range of motion (CROM) in group A (11.47±3.07) was more than that in group B(7.52±1.92). The difference between both the groups was found to be highly significant (p value <0.0001)

**Table No.6: Intra group analysis of tenderness grading of trigger point (GRADES) among two treatment groups**

| Tenderness grading | GROUP A (Post Isometric Relaxation Technique) | GROUP B (Ischemic Compression Technique) |
|---|---|---|
| | Mean ± SD | Mean ± SD |
| Pre treatment | 1.77±0.42 | 1.85±0.36 |
| Post treatment | 0.25±0.43 | 0.05±0.22 |
| p value | <0.0001****, Highly Significant | <0.0001****, Highly Significant |



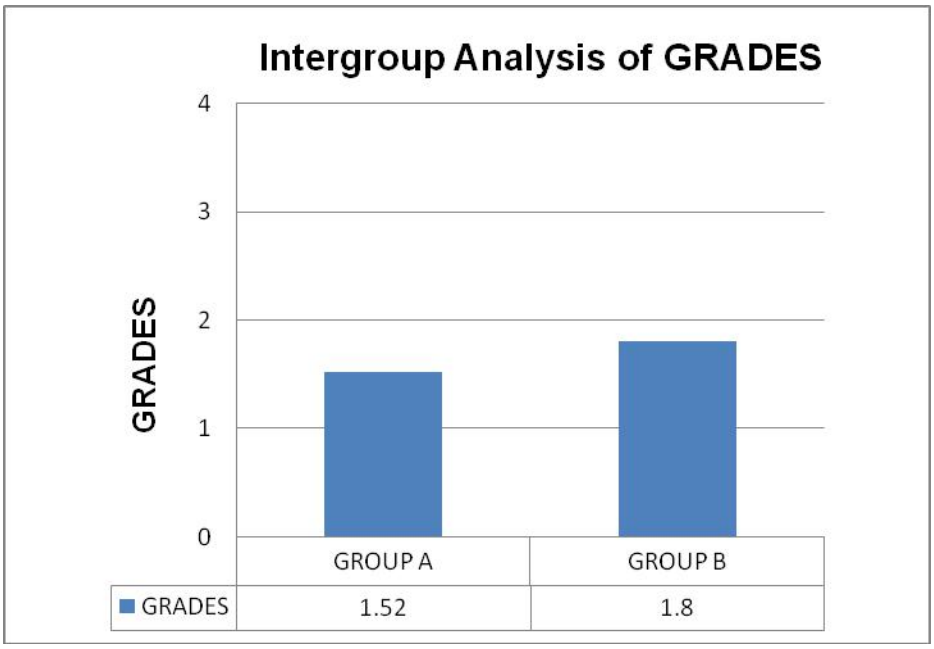

## Interpretation

The mean value of tenderness grading of trigger point pre treatment(1.77±0.42) was reduced post treatment(0.25±0.43). The difference was highly significant (p value <0.0001) following treatment with post isometric relaxation technique (Group A)

The mean value of tenderness grading of trigger point pre treatment(1.85±0.36) was reduced post treatment(0.05±0.22). The difference was highly significant (p value <0.0001) following treatment with ischemic compression technique (Group B)

**Table No.7: Intergroup analysis of GRADES between Group A and Group B**

| GRADES | GROUP A (Post Isometric Relaxation Technique) | GROUP B (Ischemic Compression Technique) | p value |
|---|---|---|---|
| Mean difference | 1.52±0.50 | 1.8±0.40 | 0.007, Significant |




### Interpretation

The mean difference value of tenderness grading of trigger point in group A (1.52±0.50) was less than that in group B (1.8±0.40). The difference between both the groups was found to be significant (p value 0.007)

## DISCUSSION

The present study was conducted to compare the effectiveness of post isometric relaxation technique and ischemic compression technique on upper trapezius trigger points in high school girls with non specific neck pain.

### Pain scoring on Visual Analog Sacle

The reduction in pain following post isometric relaxation technique is attributed to the hypoalgesic effects that can be explained by the inhibitory golgi tendon reflex which is activated during the isometric contraction. This leads to reflex relaxation of the muscle (autogenic inhibition). [22] Ameneh Yeganeh Lari et al (2016) reported muscle energy technique as a safe and non invasive method for pain relief in subjects with latent trigger points in upper trapezius muscle. [44]

Ischemic compression deliberately increases the blockage of blood to an area so that, upon release, there will be a resurgence of blood i.e., hyperaemia. [2, 3, 33] Elham Sedgh et al(2016) proposed that gate theory, endorphin and enkephalin release, and neurologic inhibition may be other mechanisms of pain reduction in MTrPs area following treatment with ischemic compression. [20]

On VAS, both the techniques were found to be equally effective. S Veena et al (2016) in their study concluded both the techniques were equally effective in reducing pain associated with upper trapezius myofascial trigger points. [24]

### Cervical side flexion (contralateral) range of motion (CROM)

Muscle lengthening brought about by post isometric relaxation technique can be ascribed to its neurological effect, when a muscle is contracted isometrically, a load is placed on the Golgi tendon organ which on cessation of effort causes a period of hypotonicity, lasting for more than 15 seconds. Rhythmic repetitive muscle contractions performed help relieve passive congestion in the paraspinal muscles occurring because of the fluctuating blood and lymph pressure gradients. In addition to this, drainage of fluid from zygapophyseal joint and segmental muscles may achieve a change in ROM and end feel.[22,23,30] G. Yatheendra Kumar et al(2014) suggested that reflex muscle relaxation following contraction has been proposed to occur by activation of the golgi tendon organs and their

inhibitory influence on the α-motor neuron pool. [6, 22]

Korr et al(2006) explained that ischemic compression as applied follows a progression from light pressure to deep pressure therefore allowing for the treatment of both superficial muscle fibres as well as deep within the course of one visit.

Following this, there would be resultant muscle lengthening and a decrease in trigger point activity, with a subsequent increase in the range of motion. The static stretch by ischemic compression would literally deform the muscle fibre, pulling apart the actin / myosin cross bridges restoring the muscle fibre to full length. [49]

Post isometric relaxation technique was found to be more effective than ischemic compression

Amit Nagrale et al (2010) proposed that local pressure may equalize the length of sarcomeres in the involved TrP and consequently decrease the pain. Additionally, the subsequent tissue relaxation created by attaining a position of TrP ease has been proposed as a mechanism of facilitating 'unopposed arterial filling' which allows for a reduction of tone in the tissues involved. This reduction in local tone further results in modification of neural reporting and improved local circulation. These changes ultimately facilitate a resetting of the neural reporting structures, resulting in a more normal resting length, enhanced circulation, decreased pain and resultant decreased tenderness. [19]

Ischemic compression is given for the purpose of eliminating point tenderness. Flushing away of any inflammatory exudates and pain metabolites such as histamine, serotonin out of muscle and breaks down the scar tissue and reduces muscle tone which eventually leads to decreased point tenderness on palpation. [30,49] ischemic compression technique was found to be more effective than post isometric relaxation technique in reducing the tenderness of trigger points in subjects with upper trapezius trigger points. The difference in effect between both the techniques can be explained as ischemic compression technique targets directly the trigger point itself and shows an immediate effect in pressure pain threshold during 1 week whereas post isometric relaxation technique has its effects over time. [9] The study conducted by Nagrale et al showed that technique in increasing the cervical side flexion (contralateral) range of motion in subjects with upper trapezius trigger points. It is noted that ischemic compression is an effective treatment, though the treatment effect is slower. It is hypothesized that this is directly related to the static nature of the stretch reflex employed during it. In relation to the static stretch reflex the degree of neurological stimulation is less than that of a dynamic stretch reflex. [49]

## Tenderness Grading Of Trigger Point:

The decrease in tenderness following treatment may be explained by the fact that it lengthens the shortened muscle fibres as explained by Travell and Simons. [10, 30]

improvement in tenderness due to trigger point occurs with MET after 4 weeks.[19] We graded the tenderness after on week itself. This might be a probable cause of reduced effect of post isometric relaxation technique.

Both groups received isometric neck exercises and upper trapezius stretching exercises. Active physical training is commonly recommended for patients with non specific neck pain. Its efficacy has been demonstrated by many studies.

Jari Ylinen, MD et al (2003) explained about the efficacy of intensive isometric neck strength training and lighter endurance training of neck muscles on pain and disability in women with chronic nonspecific neck pain. [50]

Ana Cláudia Violino Cunha et al showed the effect of global posture re education and of static stretching on pain, range of motion, and quality of life in women with chronic neck pain. They suggested that stretching exercises should be prescribed to chronic neck pain patients. [51]

Decrease in the pain following static stretching may be due to the inhibitory effectsof Golgi Tendon Organs (which imparts a reducing effect on the motor neuronal discharges, hence resulting in relaxation of the musculotendinous unit by reorganizing its latent length) and Pacinian corpuscle alteration. These reflexes ultimately permit reduction in tension in musculotendinous unit and reduced pain sensitivity. To enhance the performance of muscle, isometric exercise are frequently used. These result in an increased activation of motor units acting synchronously and

reducing or counteracting inhibitory impulses. Many postural muscles work in isometric fashion and it provides a strengthened base for dynamic exercise. [52]

## CONCLUSION

The study concludes that both post isometric relaxation technique and ischemic compression technique were effective in reducing pain on VAS, increasing cervical side flexion (contralateral) range of motion and reducing tenderness of trigger point in high school girls with upper trapezius trigger points. On comparing the two groups, both the techniques were found to be equally effective in reducing non specific neck pain. Moreover, post isometric relaxation technique was found to be signicantly more effective than ischemic compression technique in improving cervical side flexion (contralateral) range of motion. Lastly, on simple tenderness scale, ischemic compression technique was found to be more effective than post isometric relaxation technique in reducing tenderness of upper trapezius trigger points.

### Limitations & recommendations

- This study analyzed the effectiveness of post isomteric relaxation technique and ischemic compression technique with a follow up for just a week. Future studies can be carried out to examine long term effects of these interventions.
- Large sample size can be taken with a third control group to ensure more reliability and external validity of results
- Different range of age groups can be included in the study and the effects can be correlated.
- In future, studies can be done on different occupational individuals where neck pain is common.
- Functional measures showing improvement in the patient's status such as Neck Disability Index (NDI) can also be included as an outcome measure of the study

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