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Comparison between immediate effect of integrated neuromuscular inhibition technique and active release technique on chronic neck pain and upper trapezius trigger points

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Abstract

18-40yrs individuals with chronic neck pain and upper trapezius trigger points, were randomly allocated to intervention groups, group1=Integrated Neuromuscular Inhibition Technique and group2=Active Release Technique (n=18 each), given for one session. Outcome measures were pain intensity, pain threshold (Bilateral sides) using Numerical Pain Rating Scale (NPRS), Pressure Pain Threshold respectively and also Cervical ROM (Lateral flexion and rotation on bilateral sides). All outcomes were measured pre and post treatment (Immediate and after 24hrs). Paired t test for the three periods of group1 values of all outcomes except rotation (Right) were found highly significant and in group 2, all outcomes were found highly significant. Unpaired t test values for NPRS and rotation(right) among pre intervention, Numerical Pain Rating Scale and Lateral Flexion (Bilateral) among post immediate, NPRS and rotation (Bilateral) among post 24hrs were all found significant. Both interventions were found effective but active release technique revealed better in pain reduction and Integrated Neuromuscular Inhibition Technique beneficial in improvement.

Keywords: Chronic neck pain, upper trapezius trigger point, integrated neuromuscular inhibition technique, ischemic compression, muscle energy technique, strain counter strain, active release technique

1. Introduction

Chronic neck pain is amongst the commonest musculoskeletal problems and is characterized by pain duration longer than 12 weeks or 3 months^[1]. In general population, the prevalence of neck pain has been reported to range between 30% and 50%, and upto 30% men and 50% women experiences neck pain in the course of a lifetime^[2-4]. It is a condition that places a large economic burden on the health care system^[5].

Myofascial Trigger Points (MTrPs) is described as a 'common cause of pain'^[6,7]. It is defined as discrete, hyperirritable foci usually located within taut bands of skeletal muscle or fascia which when compressed produces a characteristic referred pain. Tenderness and autonomic phenomena as well as decreased skin resistance when compared with adjacent tissues^[8]. MTrPs commonly develop in upper trapezius^[9].

Numerous variety of both manual and non-manual interventions exist for inactivation of TrPs. Integrated Neuromuscular Inhibition Technique (INIT) is a combination of three manual techniques, namely, Ischaemic Compression (IC), Muscle Energy Technique (MET) and Strain Counter-Strain (SCS). Chaitow L. stated that INIT can be an effective method in treating trigger points^[10]. It has been reported that the benefit of the technique lies in its multifaceted approach^[11].

On the other hand, Active Release Technique (ART) is a manual therapy for the recovery of soft tissue function that involves the removal of scar tissue, which can cause pain, stiffness, muscle weakness, and abnormal sensations including mechanical dysfunction in the muscles, myofascia, and soft tissue^[12]. The effectiveness of ART has been reported for carpal tunnel syndrome, achilles tendonitis, tennis elbow and hamstring flexibility, cervical pain, all of which involves soft tissue near joints in the distal parts of the body^[13] ART has been echoed as an acknowledging treatment for soft tissue injuries by different authors^[14, 15, 16, 17, 18].

There is limited evidence showing immediate effectiveness of INIT and ART on pain intensity, threshold and Cervical ROM (CROM) in chronic neck pain and upper trapezius TrPs. The current status of the literature necessitates further research in this area.

To our knowledge, there is no study which compared the immediate effectiveness of INIT and ART in individuals with chronic neck pain. If either of the intervention is found to be more effective as immediate treatment, then that can be used as a treatment technique which will aid in immediate reduction of pain and restriction in CROM.

Therefore, the purpose of study was to compare the immediate effect of integrated neuromuscular inhibition technique and active release technique on pain intensity, pain threshold and CROM in individuals with chronic neck pain and upper trapezius trigger points.

2. Methods

2.1 Ethics

The study was approved by institutional ethics committee. Written informed consent was obtained from all participants following a detailed description of the study's purpose. Data were collected during the period of May 2018 to April 2019.

2.2 Study population

Participants were screened and evaluated for neck pain and upper trapezius trigger points by performing special tests to rule out other diagnosis such as cervical radiculopathy, degenerative pathology etc.

With 95% confidence level and 90% power, the sample size was calculated based to the parameters of Nagarle AV *et al.* [19] which comes to be n=18 in each group based on the formula:

$$n = \frac{2 (Z(\alpha/2) + Z(1 - \beta))^2 \sigma^2}{d^2}$$

Given the inclusion and exclusion criteria, a total of 36 participants were recruited. Inclusion criteria were neck pain over 3 months along with upper trapezius trigger points, aged between 18-40 years. Subjects were excluded if they had history of neck or shoulder trauma, neck or shoulder surgery, moderate to severe cervical, thoracic and shoulder degenerative pathology, any systemic disorder, spinal deformities, cervical radiculopathy, fibromyalgia syndrome, neuromuscular entrapment or compression syndrome of cervical spine or shoulder origin and also those who were receiving treatments such as vapo-coolants, dry needling, acupuncture, analgesics. If the individual was unable to provide consent due to any reason, they were not approached to take part in the study.

2.3 Intervention: Based on random allocation by using envelope method, where 2 different coloured papers each denoting either group 1 or group 2 was kept inside separate

envelopes and one of the envelope was chosen by the patient and the subject was placed accordingly to group 1 or group 2. Group 1 received INIT and ART was provided for group 2.

2.3.1 Group 1: INIT

The subject was asked to lie supine. A towel was placed under the neck in order to reduce activity in the upper trapezius. Three different techniques were performed in the following sequence [20]:

- 1. IC:** Pressure was applied over a specific trigger point using pincher grip between the thumb and index finger and was maintained until the pain decreased. Then, there was application of again until the subject reported discomfort. It was performed for 90 seconds and was repeated for three to five times.
- 2. SCS:** Slight application of pressure on a trigger point until pain was felt; this pressure was maintained until the position of ease was identified. In order to position the upper trapezius in a shortened/relaxed position, the patient was placed into a supine position, and the therapist laterally flex the subject's head towards the involved side, while positioning the ipsilateral arm in abduction or flexion to reduce tender point pain. Once the position of ease was achieved, it is maintained for 20 to 30 seconds and then repeated three times.
- 3. MET:** Patient was asked to simultaneously shrug the involved shoulder towards the ear, as well as bring the ear closer to the shoulder, against resistance. The isometric contraction was held for 7-10 seconds. Following the contraction, contralateral side flexion and ipsilateral rotation was applied to initiate a local tissue stretch, in the tissues in which the trigger point was located. Stretch was held for 30 seconds and the procedure was repeated 3-5 times.

The treatment was performed for one session and lasted for about 15-20 minutes.

2.3.2 Group 2: ART

The therapist trapped the affected upper trapezius muscle (s) by applying pressure or tension with his/her thumb or finger over the MTrP [21]. The patient was then asked to actively move the neck from a shortened position towards the elongated position which was contralateral neck side flexion and ipsilateral neck rotation while the therapist continued to apply tension to the MTrP. while applying the ART, the patient was sitting on a chair leaning backwards with his/her hands placed on his/her thighs. Intervention for each individual lasted for 15 minutes [21].

Pain intensity using Numerical Pain Rating Scale (NPRS), Pressure Pain Threshold (PPT) and CROM [Lateral Flexion (LF) and Rotation (ROT)] was measured pre intervention and immediately (after five minutes) and 24 hours following the intervention. The subjects were asked not to receive any other intervention for neck pain for 24 hrs.



Fig 1: Shows the interventions performed A) Ischaemic compression B) Strain CounterStrain C) Muscle Energy Technique D) & E) Active Release Technique

2.4 Outcome measures

NPRS is a patient reported outcome measure questionnaire with a scale range from '0' representing "no pain" to '10' representing "worst pain imaginable" [22, 23, 24]. Ferraz *et al.* reported that the 11-point NPRS have good test-retest reliability ($r \geq .79$), (ICC = 0.86-0.95) [25].

PPT is defined as the least stimulus intensity at which a subject perceives pain. PPT is determined by a device called Pressure Algometer. It is a force gauge fitted with a rubber disc having a surface of 1cm^2 . Pressure can be applied to a defined surface on the body through the rubber disc. Pressure exerted on the rod moves the indicator in a clockwise direction. Pressing the zeroing knob returns the indicator to zero after each measurement. The achieved force value is held until the zeroing knob is pressed (Maximum hold function). Allowing a reading even after the meter is removed from the body [26] Reeves *et al.* demonstrated that pressure algometer is

a reliable and valid measure of trigger point sensitivity [27]. CROM is assessed using universal goniometer. Youdas JW *et al.* has concluded that inter-tester reliability of cervical lateral flexion (ICC = 0.84) and rotation (ICC = 0.90) [28].

2.5 Statistical analysis

Statistical analyses were done using software SPSS (windows version 17.0). Quantitative variables were analysed by paired t-test for pre and post NPRS, PPT and CROM and unpaired t-test for the 2 groups (i.e. INIT and ART groups). Statistical significance was set at $p < 0.05$.

3. Result & Discussion

A total of 36 subjects were randomly allocated into two equal groups of 18 each. Each group consisted of 9 women and 9 men. The flow of participants through the study is presented in Fig. 2

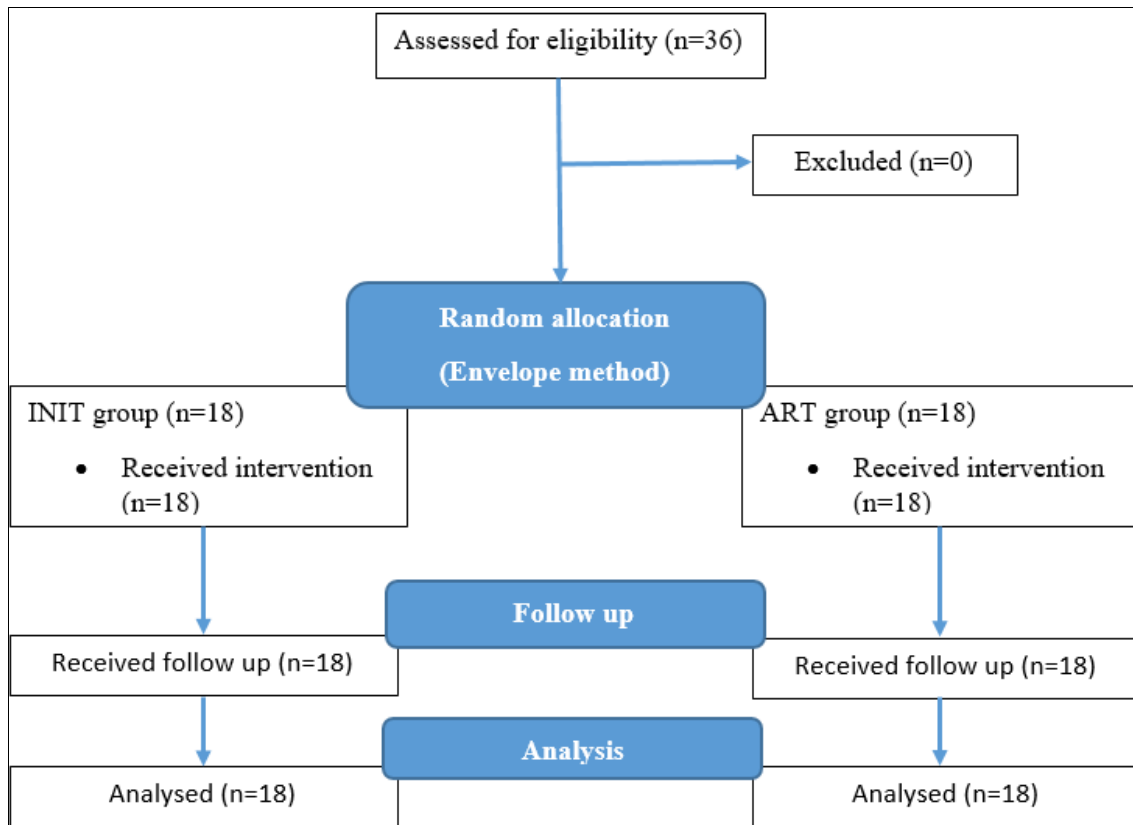


Fig 2: Participant flow diagram

Table 1: Comparison between pre and post INIT

	Pre & Post immediate		Pre & Post 24 hrs	
	t	p	t	p
NPRS	8.841	0.000	9.994	0.000
PPT rt	-7.685	0.000	-11.097	0.000
PPT lt	-7.326	0.000	-8.922	0.000
LF rt	-9.725	0.000	-2.764	0.000
LF lt	-13.835	0.000	-12.450	0.000
ROT rt	-2.037	0.058	-2.509	0.023
ROT lt	-5.218	0.000	-6.066	0.000

Paired t test values for pre and post immediate INIT values of NPRS, PPT rt, PPT lt, LF rt, LF lt, ROT lt were found to be highly significant, whereas ROT rt was not statistically significant.

Also, paired t test values for pre and post 24 hrs INIT values of NPRS, PPT rt, PPT lt, LF rt, LF lt, ROT lt were found to

be highly significant, whereas ROT rt was not statistically significant.

Table 2: Comparison between pre and post ART

	Pre & post immediate		Pre & post 24 hrs	
	t	p	t	p
NPRS	10.000	0.000	10.303	0.000
PPT rt	-4.876	0.000	-7.411	0.000
PPT lt	-6.124	0.000	-7.998	0.000
LF rt	-6.1666	0.000	-7.601	0.000
LF lt	-6.527	0.000	-5.939	0.000
ROT rt	-5.864	0.000	-8.730	0.000
ROT lt	-3.513	0.003	-5.445	0.000

Paired t test values for pre and post immediate and also between pre and post 24 hrs ART values of all the outcome measures were found to be highly significant statistically.

Table 3: Comparison between INIT & ART group

	Pre intervention		Post immediate		Post 24 hrs	
	t	p	t	p	t	p
NPRS	3.325	0.002	2.315	0.027	3.339	0.027
PPT rt	-1.946	0.060	0.293	0.771	-0.983	0.333
PPT lt	-0.915	0.367	0.080	0.936	-0.154	0.897
LF rt	0.420	0.677	-4.027	0.000	-1.941	0.061
LF lt	0.563	0.577	-2.893	0.007	-1.720	0.094
ROT rt	-2.796	0.008	-0.200	0.843	-5.593	0.000
ROT lt	-1.977	0.056	-0.453	0.653	-5.462	0.000

Independent t test values between INIT and ART in the pre intervention group was obtained as statistically significant in NPRS and ROT rt. Among post immediate NPRS, LF rt, LF lt

were revealed statistically significant. And post 24 hrs, NPRS, ROT rt and ROT lt were statistically significant.

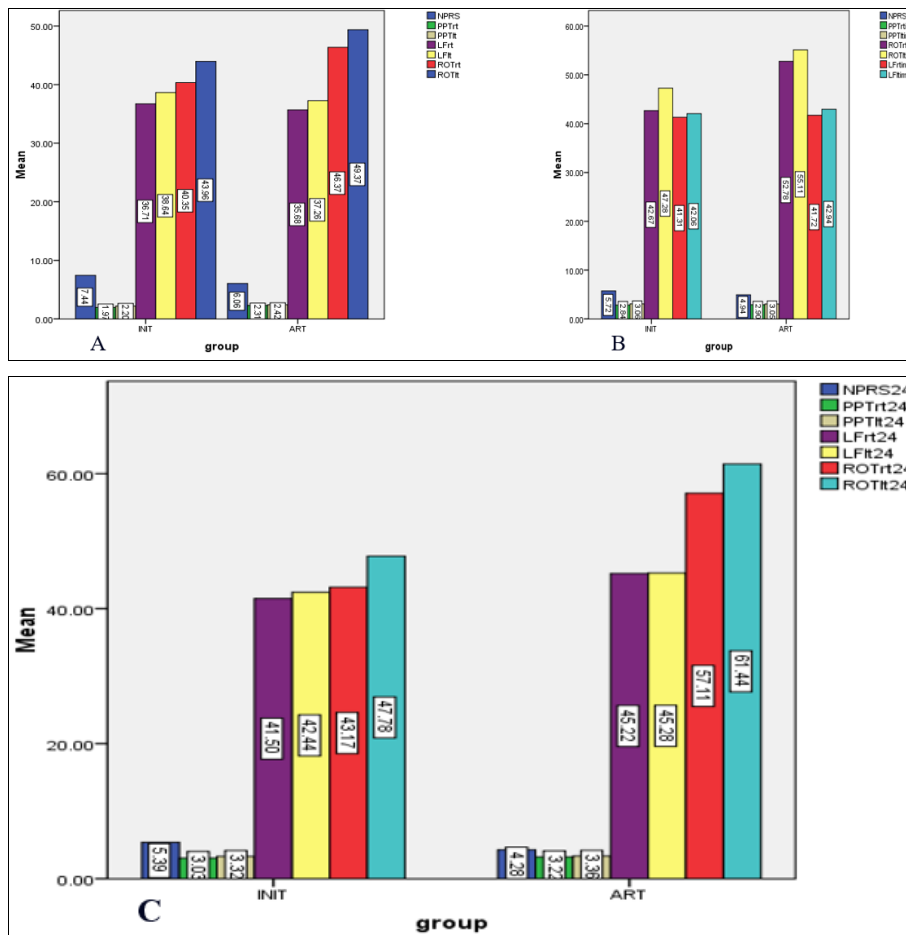


Fig 3: shows bar diagram of the mean of outcome measures in both INIT and ART group in (A) Pre intervention (B) Post immediate (C) Post 24 hrs

3.1 Discussion

A total of 45 individuals with chronic neck pain were screened for the study, inclusive of inmates of chronic neck pain and upper trapezius trigger points. 36 subjects fulfilling inclusion criteria were enrolled for the study. The subjects were randomly allocated into two different groups (Intervention and control) with equal numbers each (N=18), using envelope method. One group received INIT whereas another group receives ART. No subjects dropped out of the study after enrolment. Data from all 36 individuals was collected pre, immediately after and post 24 hrs of the intervention and was analysed. Present study was performed for comparison between the immediate effectiveness of INIT and ART on pain intensity and threshold and cervical range of motion in individuals with chronic neck pain and upper trapezius trigger points.

Subjects receiving INIT had a reduction in their pain intensity by mean difference of NPRS as 1.72 and 2.05 in post immediate and post 24hrs respectively. P value in comparison between pre and post immediate INIT of NPRS, PPT rt, PPT lt, LF rt, LF lt and ROT lt was 0.000 and ROT rt was 0.058 ($p < 0.05$).

Present study results are in accordance with previously published trials by Saadat Z *et al.* who found out the effects of INIT on pain threshold and pain intensity in patients with upper trapezius trigger points. Author found that there seems to be an immediate reduction in pain intensity in patients with upper trapezius trigger points by INIT [20].

This paper has shown improvement in their mean value of PPT rt, PPT lt, LF rt, LF lt, ROT rt and ROT lt by (0.87, 1.06), (0.86, 1.12), (5.96, 4.79), (8.64, 3.8), (0.96, 2.82), (1.87, 3.85) in post immediate and post 24 hrs respectively. P value

in comparison between pre and post 24hrs INIT of NPRS, PPT rt, PPT lt, LF rt, LF lt and ROT lt was 0.000 and ROT rt was 0.023 ($p < 0.05$).

A study performed by Sibby *et al.* to find out the effectiveness of INIT and LASER with stretching in the treatment of upper trapezius trigger points. Visual numeric pain scale and NDI questionnaire, CROM was measured. Treatment duration was alternate days for two weeks, with a total of six sessions. The author suggested that both INIT and LASER with stretching are equally effective in managing subjects with neck pain due to upper trapezius trigger point. Author found that there was improvement in reduction of neck pain and also improving CROM, which is in agreement with the present study [29].

Three manual treatment techniques together attributed to the effect of INIT. Firstly, IC leads to reduction of pain by stimulation of A-beta fibers that affect the pain gate during pressure and increase circulation when the pressure release [30, 31, 32, 33]. Secondly, SCS allows reduction of pain, improvement of function and ROM by placing the muscle at the passive shortened position. This position restores normal activity of muscle spindle and increases blood supply to the muscle [34, 35, 36, 37]. Finally, MET plays a key role in decrease pain; improve function and ROM by working on autogenic inhibition of muscle. This technique performed by applying isometric contraction of muscle that leads to activation of Golgi tendon organ that produces relaxation of the muscle. Furthermore, MET plays an important role in increasing range of motion by changes in muscle extensibility – reflex relaxation, viscoelastic change and stretch changes [33, 37].

Subjects receiving ART had a reduction in their pain intensity by mean difference of NPRS as 1.12 and 1.78 in post immediate and post 24hrs respectively. Also, they had

improvement in their mean value of PPT rt, PPT lt, LF rt, LF lt, ROT rt and ROT lt by (0.91, 0.32), (0.94, 0.31), (9.54,7.56), (8.02,9.83), (10.74,15.39), (12.07, 18.5) in post immediate and post 24 hrs respectively. P value in comparison between pre and post immediate INIT of NPRS, PPT rt, PPT lt, LF rt, LF lt and ROT rt was 0.000 and ROT lt was 0.003 ($p<0.05$). P value in comparison between pre and post 24hrs INIT of NPRS, PPT rt, PPT lt, LF rt, LF lt and ROT lt was 0.000 ($p<0.05$).

All the outcome measures were found to be significant and has greatly shown improvement immediately and post 24 hrs of the intervention (ART). Our study is supported by Sadria G *et al.* who compared the effectiveness of ART and MET on latent trigger points of the upper trapezius. VAS and active cervical lateral flexion and upper trapezius thickness were assessed as outcome measure. There is reduction in pain and upper trapezius thickness and also amelioration of pain [38].

Also, George *et al.* investigated the immediate effect of a single session of ART in increasing hamstring flexibility among healthy men. Outcome measure was sit-and-reach-test, which was performed prior and post treatment. Single session ART has shown to increase hamstring flexibility ($p<0.001$) [39]. Dr. Michael Leahy developed ART [40], proposed a mechanism to rationalize increased tissue stiffness or tension called the cumulative injury cycle. According to this, increase in the friction and tension within the myofascial structures occurs due to repetitive micro-injury in tight muscles. [39] Mechanical stimulation stimulates IV receptors and their activation in turn stimulates the supraspinal pathway which results in inhibitory neurotransmitter endocannabinoid (EC) release. EC in the CNS, induces pre-synaptic inhibition which, then reduces muscle tone and breaks down the pain-spasm-pain cycle [41].

P value in comparison between INIT and ART in the three periods (pre, post immediate and post 24 hrs) were obtained and showed that NPRS in all the three periods had high significance with p (0.002, 0.002 and 0.027 respectively) and LF right post immediate had high significance ($p=0.000$) and ROT right and left had high significance with p (0.000) at significance level ($p<0.05$).

This might be the first study which compares the two techniques. Individually both INIT and ART were found to be effective. However, ART was found to be better than INIT in pain reduction, the reason being the release of inhibitory neurotransmitter endocannabinoid (EC) on mechanical stimulation causes pre-synaptic inhibition which, then reduces muscle tone and breaks down the pain-spasm-pain cycle. [41] whereas, CROM was found to be increased in INIT group which can be because of combined effect of SCS and MET, where SCS acts on muscle spindle and increase in blood supply by keeping the muscle at passive shortened position and in MET, autogenic inhibition of muscle causes reduction in muscle spasm [35, 39].

3.2 Limitations

The study has limitations as there was no evaluation of long term follow up, so long term impacts are unknown. The study was done only on subjects of age group between 18-40 yrs. The focus was only on upper trapezius trigger point and not on the other muscles which can cause neck pain. It did not focus on a particular occupation or a more distinct population. No particular type of trigger point was emphasised.

4. Conclusion

In this study, it was found that the immediately after and post

24hrs of both the treatment techniques (INIT and ART) have shown neck pain amelioration and improvement in cervical range of motion. However, ART was seen to be more effective in pain reduction and INIT was found better in cervical ROM improvement.

4.1 Clinical implication

These techniques can be recommended for individuals with chronic neck pain and upper trapezius trigger point.

5. Conflict of interest

Authors declare that there is no conflict of interest.

6. Funding/ Support

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