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A study to compare the effectiveness of classical strain / counterstrain technique with ultrasound therapy and myofascial release technique with ultrasound therapy on unilateral upper trapezius trigger points

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Abstract

Background: Neck pain is very common in the region of the upper trapezius muscle. Highest prevalence is seen in middle aged groups. Women are more affected than men.

Objective: To assess the effectiveness of classical strain/counterstrain technique with ultrasound therapy and myofascial release technique with ultrasound therapy to reduce pain and to improve cervical lateral flexion ROM on subjects with trigger point pain in unilateral upper trapezius.

Design: Randomized comparative parallel open label study

Materials and Method: 60 participants with upper trapezius trigger points of both the sex were randomly divided into group A and group B, 30 in each group. Group A was treated with classical strain/counterstrain technique with ultrasound therapy and Group B was treated with myofascial release technique with ultrasound therapy for 5days continuously 1 session per day. Patients were evaluated with VAS, NDI scores and CROM on day 1 and day 5.

Result: Efficacy of Classical strain/counterstrain technique with ultrasound therapy was more effective in relieving pain, improving functional ability and increase in ROM.

Conclusion: Classical Strain/counterstrain technique with ultrasound therapy was significant than Myofascial release technique with ultrasound therapy in patients with unilateral trigger point of upper trapezius.

Keywords: ultrasound therapy, strain/counterstrain technique, myofascial release technique, unilateral trigger points of upper trapezius, visual analogue scale (VAS), neck disability index (NDI),cervical range of motion (CROM)

Introduction

The skeletal muscle is the single largest organ in the human body. It accounts "for nearly 50% of the body weight. Any of these muscles may develop pain and dysfunction.[1] Often, the muscles used to maintain body posture are affected, namely the muscles in the neck, shoulders, and pelvic girdle, including the upper trapezius, scalene, sternocleidomastoid, levator scapulae, and quadratus lumborum. In the head and neck region, myofascial pain syndrome with trigger points can manifest tension headache, tinnitus, temporomandibular joint pain, eye symptoms, and torticollis [2]. The upper trapezius muscle are designated as postural muscle and it is highly susceptible to overuse. Trapezius muscles help with the function of neck rotation, lateral flexion and extension [1]. There are many epidemiologic studies suggesting that myofascial pain syndrome is an important source of musculoskeletal dysfunction [3]. Neck pain is very common in the region of the upper trapezius muscle. Highest prevalence is seen in middle aged groups. Women are more affected than men. Neck pain prevalence varies widely in different studies, with a mean point prevalence of 13% (range 5.9% – 38.7%) and mean lifetime prevalence of 50% (range 14.2% – 71.0%) [4]. Travell defined a myofascial trigger point as "a hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band" [5]. This spot is tender which is located within a taut band of skeletal muscle that is painful on compression or on stretch and that can give rise to a typical motor, sensory and autonomic components [6]. Sensory aspects include local tenderness, referral pain, peripheral and central sensitization. Motor aspects include disturbed motor functions like, muscle weakness, muscle stiffness and restricted range of motion [6]. Trigger points are classified as being active or latent, depending on their clinical characteristics. An active trigger point causes pain at rest. It is tender on palpation with a referred pain pattern that is similar to the patient's pain complaint. This referred pain is felt not at the site of the trigger-point origin, but remote from it. The pain is often described as spreading or radiating. Referred pain is an important characteristic of a trigger point. A latent trigger point does not cause spontaneous pain, but may restrict movement or cause muscle weakness. The patient presenting with movement restriction or muscle weakness may become aware of pain originating from a latent trigger point only when pressure is applied directly over the point [2]. Muscle spasm occurs early after injury. Which feels like tightness in the muscles and is sometimes painful. When this basic injury is

not treated, it further causes formation of muscle knots, called trigger points. These knots are formed because the spasm keeps the muscle continuously "on". As muscles are not designed for this continuous work, and over a period this muscle gets overloaded and forms these knots. As a result treatment of the spasm is necessary to reduce this problem. This happens most often with injuries to the neck and back. The myofascial trigger point in the trapezius is most commonly found at the midpoint of the upper border of the muscle.[4] Trauma can either be acute or chronic which cause sarcoplasmic reticulum of the muscle to tear and release calcium. This calcium and ATP causes the sarcomere to contract, which shortens the muscle in a localized area producing taut bands. This generates high level of metabolic activity and ischemia in the area, thus releasing of substances that cause hyperirritability of sensory nerve endings and produce pain [4]. Myofacial trigger points (MTrPs) are seen in people who work at desks and computers or who spend many hours driving, where in case the upper trapezius becomes sore and painful.[1] MTrPs can develop from a number of conditions including genetics, aging, and strenuous activity. It can also be brought on by macro-trauma or by cumulative micro-trauma. Abnormal posture, repetitive motion and psychological stresses are examples of cumulative micro-trauma [9]. Predisposing activities include holding a telephone receiver between the ear and shoulder to free arms; prolonged bending over a table; sitting in chairs with poor back support, improper height of arm rests or none at all; and moving boxes using improper body mechanics [2]. MTrPs can be deactivated temporarily by occluding their blood supply and can cause a reactive increase in blood supply, where in it effectively flushes out the inflammatory exudates and pain metabolites from the muscle, helps in breaking down the scar tissue, and thus reduces muscle tone. The muscle is then nourished by the extra flow of blood, where in the nerve endings are desensitized, and the scar tissue is broken down [2].

No laboratory test or imaging technique has been established for diagnosing trigger points. However, the use of ultrasonography, electromyography, thermography, and muscle biopsy has been studied [2]. There are many treatments approach are available in physical therapy to deactivate the MTrPs such as Ischemic compression technique, spray and stretch technique, Strain/Counterstrain technique, Trigger point pressure release technique, Ultrasound deep heat therapy, Thermo Therapy, Laser Therapy, Needling Therapies, Transverse Friction massage, Post isometric relaxation (MET), Electrical muscle stimulator, Stretching etc [2].

Ultrasound: Ultrasound refers to mechanical vibration or sometimes been described as micro massage which are essentially the same as sound waves but of a higher frequency. Frequencies of a few megahertz that are typically used therapeutically and diagnostically, in which mechanical oscillation frequencies range from about 1 to 3MHz. Ultrasound carries mainly two different modes such as continuous and pulsed mode, where in Ultrasound waves are produced mechanically by vibrating a material medium, either solid, liquid, or gas. Ultrasound frequency of 1MHz is preferable when treating large soft tissue volumes where the bone is located. If the overlying tissue thickness is small, i.e. if the bone is more superficially located, one option is to use a frequency of 3MHz and the other is a lower intensity of 1MHz than if the bone had more overlying muscles. Regions of compression are separated by a fixed distance of wavelength (λ) Compressive disturbance travels through the medium at a constant velocity (v), measured in meters per second (ms^{-1}). These waves of compression through matter is normally invisible because the amount of compression is small.[8] The impact of ultrasound on trigger point sensitivity has been investigated previously in combination with other modalities such as exercise and medication. An unique technique using (supratherapeutic) high-power ultrasound administered at pain threshold intensities was found to be superior to conventional ultrasound techniques for reducing subjective visual analogue scale pain scores and increasing cervical range of motion [10].

Strain /counterstrain: Strain/counter strain (S-CS) is a gentle, indirect manipulative technique for the treatment of somatic dysfunction. It is one of several treatment approaches where positioning of the body is used to evoke a therapeutic effect.[2] The classical description of this technique was made by Jones in 1981 who recommended the adoption of a position of comfort for dysfunctional tissue exhibiting tender points [7]. A number of studies have reported the use of strain/counterstrain in combination with other interventions for treating a variety of disorders, including chondromalacia patellae, pancreatitis, low back pain, and cervicothoracic pain [7]. Dardzinski *et al*. found that the strain/counterstrain technique was effective in reducing pain and improving function in patients with localized myofascial pain syndrome.[7] This technique is classified into two types saying classical and modified strain/counterstrain technique, where in a longitudinal stroke is applied in modified strain/counterstrain technique with the aim of achieving a greater decrease in pain [7].

Myofascial release technique: Myofascial release is a soft tissue mobilization technique defined as "the facilitation of mechanical, neural and psychological adaptive potential as interfaced via the myofascial system [4]. By MFR there is a change in the viscosity of the ground substance to a more fluid state which eliminates the fascia's excessive pressure on the pain sensitive structure and restores proper alignment. This technique acts as catalyst in the reduction of trapezius spasm [4].

In order to measure the pain, visual analog scale is good and reliable tool in clinical research. Normal range of motion (ROM) of the active cervical spine has been often altered by disorders or pathology of the cervical spine which limits the active cervical range of motion. The universal goniometer (UG) is commonly used as measurement device for measuring cervical ROM as it is accurate, reliable, easy to use and less expensive. The neck disability index (NDI) described by vernon's and mior is based on the Oswestry low back pain disability index and specifically measures activity limitations due to trigger point pain in unilateral upper trapezius.

Materials and Methodology

It is a two group of randomized comparative study comprising sample size of 60 (30) in each group. A random sampling method was used as a sampling method, with a study duration of 12months. Data was collected from KIMS inpatient and

outpatient department of orthopedics and outpatient department of physiotherapy.
Materials used in this study was

- Universal goniometer, Therapeutic Ultrasound, Ultrasound gel, Cotton, Pillow, Data collection /record sheet, Neck disability index scale, VAS

Participants
60(30) subjects were recruited by random sampling
Inclusion criteria: Age group 20-40years, Both genders male and female, Unilateral upper trapezius trigger point Symptoms lasting for at least 0-2weeks, Subjects diagnosed with trigger point in upper fibers of trapezius by orthopedic surgeon, Excruciating spot tenderness at one point along the length of the taut band of the upper trapezius muscle, Pain on VAS should be > 3 /10, Pain elevated by elongating (stretching) the trapezius muscle and on palpation, Patient with primary myofascial pain syndrome(no pain at any other area than the corresponding trigger point; pain mostly on contralateral bending of head; negative spurling test) Exclusion criteria: Acute or serious illness, Advanced osteopathic or arthropathic disorder of cervical spine or shoulder, Patient with application of any medications to relieve pain, Traumatic Neck Injury, Fracture of cervical vertebras, Cervical Radiculopathy, Diagnosis of fibromyalgia, Spondylolysthesis of the cervical spine, A history of heart disease or the presence of a pacemaker, Psychological disorder or Mental retardation, Pregnancy and lactation mother were excluded.
All the participants were informed that the use of the collected data is purely for the purpose of the study and that the recordings would be destroyed at the end of the study. The subjects were also informed about the anonymity of their names and other identifiable traits.

Study design
Randomized comparative parallel open label study

Outcome measures
Before the beginning of the rehabilitation protocol and after 5 days of treatment, all the patients will be evaluated in the following outcome measures.

1. Visual Analogue Scale (VAS)
2. Cervical lateral flexion range of motion(CROM)
3. Neck disability index (NDI)

Procedure
The Group A and Group B will be treated accordingly once daily for 5consecutive days.
Group A: 30 subjects will be treated with strain/counterstrain technique with ultrasound therapy.
Subjects are seated with the cervical spine in a neutral position. The tender point is located in the upper trapezius muscle by manual palpation. Once the tender point is located, gradually increasing pressure is applied until the sensation of pressure becomes one of the pressure & pain. Now the subject is passively placed in a position that reduces tension under the palpating fingers & causes a subjective reduction of pain by around 70%. The position as follows may be used – Cervical flexion, ipsi-lateral side-flexion, and a slightly contra-lateral cervical rotation (e.g.5 to 8^0) The subject's upper extremity is previously positioned in passive abduction. The same position will be maintained for 90s and repeated for three to five times. Then finally subject was slowly passively placed in the starting position (neutral position of cervical spine) [13] (fig:1)

Fig 1: Subject Receiving Strain/Counterstrain Technique

Group B: 30 subjects will be treated with myofascial release technique with ultrasound therapy. Position of the patient – sitting comfortably with supported back, elbow flexed with forearm placed on a pillow. Deep transverse friction will be given for 10 minutes followed by myofascial stretching of upper trapezius muscle for 3 times, each holding for 90 seconds just until resistance (tissue barrier) is felt. Then myofascial release is given to the upper trapezius using the right thumb with the left thumb reinforcing it from the top. Then myofascial release will be given to the upper trapezius by using ulnar border of both the palms, by positioning the subjects with opposite side flexion of cervical spine.[5] (fig: 2)

Fig 2: Subject Receiving Myofascial Release Technique

Ultrasound therapy: Position of the patient – sitting comfortably with supported back, elbow flexed with forearm placed on a pillow A Electronson – 709 ultrasound machine was used. The subject will be informed that continuous ultrasound is going to be used. In most cases, continuous-wave mode is preferred to maximize thermal effect The continuous mode of 1.5W/cm^2 dose for 5 minutes was applied directly over the MTrPs and ultrasound head is moved in smooth overlapping sweeps or circles at rate of a few centimeters per second over areas of 25 to 100cm^2 over the ultrasound gel on the upper trapezius muscle in the region of the MTrPs.[22] (fig: 3).

Fig 3: Subject Receiving Ultrasound Therapy

Data Collection
Data collected will be analyzed by statistically in form of table

with frequency and percentage, and representing graphically. For the inferential statistics after verification of normality assumption either student t-test or Wilcoxon test will be applied to see the effectiveness within the group and unpaired t-test or Mann-Whitney U test to test the improvement between 2 groups. Results is considered statistically significant if $P \leq 0.05$.

Data Analysis and Results

Table 1: Frequency and Percentage distribution of age for Group-A and Group – B

Age	Group – A		Group – B	
	Frequency	Percentage	Frequency	Percentage
20 – 30 Year	13	43.3	23	76.7
31 – 40 Year	17	56.7	7	23.3
Total	30	100	30	100

Interpretation

Above table shows Frequency and Percentage of age for Group-A and Group-B. Overall 20 to 40 year age group clients were participated in the study. Majority of 56.7% of participants were belongs to the age group 31- 40 years in Group-A and in Group- B Majority of 76.7% of participants were belongs to the age group of 20-30 years.

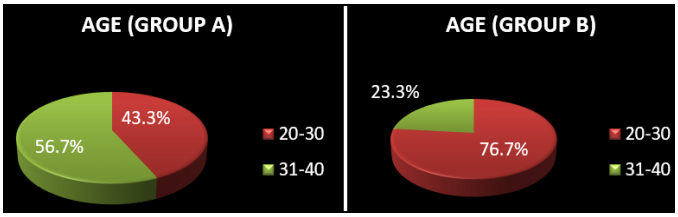

Fig 4: Percentage Distribution of Age for Group-A and Group-B

Table 2: Gender Comparison

	Male	Female
Group A	15	15
Group B	16	14

Above table shows gender distribution for group A and group B 15 males and 15 females were participated in group A and 16 males and 14 females in group B

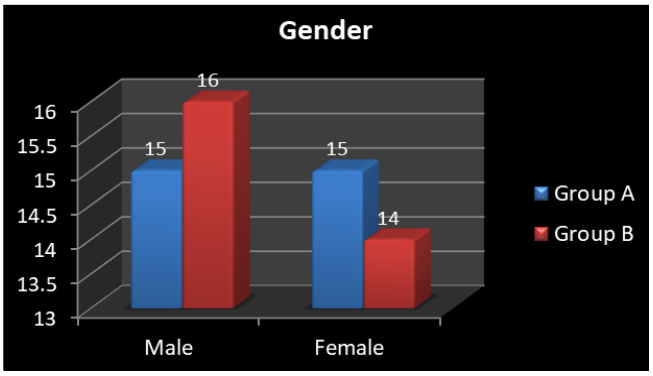

Fig 5: Gender distribution of Group A and Group B

Table 3: Between group comparasion- vas scale

VAS score	p value	t value	Mean ±SD
Group A Post VAS score	<0.0001exteremely tatistically significant	4.969	4.33±1.03
Group B Post VAS score			3.07± 0.94

Interpretation

The above table shows unpaired t-test for VAS. The two tailed P value is <0.0001 which is considered to be extremely significant. The risk to reject the null hypothesis is t= 4.9690; df= 58; standard deviation= 0.255

Table 4: Between group comparasion- ndi

NDI(%) score	p value	t value	Mean ±SD
Group A Post NDI(%) score	=0.0021 is very statistically significant	3.225	24.93±5.7
Group B Post NDI(%) score			19.57±7.11

Interpretation

The above table shows unpaired t-test for NDI. The two tailed P value is equals to 0.0021 which is considered to be very statistically significant. As the computed p-value is higher than the significance level alpha=0.0021, the risk to reject the null hypothesis is t= 3.2250; df= 58; standard deviation= 1.664.

Table 5: Between group comparasion- active crom

Post active CROM	p value	t value	Mean±SD
Group A Post Active CROM	=0.0323 statistically significant	2.192	8.57±3.87
Group B Post Active CROM			6.87±1.74

Interpretation

The above table shows unpaired t-test for cervical lateral flexion AROM. The two tailed P value is equals to 0.0323 which is considered to be statistically significant. As the computed p-value is higher than the significance level alpha=0.0323, the risk to reject the null hypothesis is t= 2.1929; df= 58; standard deviation= 0.775.

Table 6: Between group comparasion- passive crom

Post Passive CROM	p value	t value	Mean ±SD
Group A Post Passive CROM	=0.0483 statistically significant	2.0177	5.2±1.56
Group B Post Passive CROM			4.3±1.88

Interpretation

The above table shows unpaired t-test for cervical lateral flexion PROM. The two tailed P value is equals to 0.0483 which is considered to be statistically significant. As the computed p-value is higher than the significance level alpha=0.0483, the risk to reject the null hypothesis is t= 2.0177; df= 58; standard deviation= 0.446

Discussion

The upper trapezius muscle plays an important role in the stability and mobility of the neck region. Formation of trigger points in upper trapezius gives rise to specific pain patterns either in the neck, shoulder and upper limbs. Trigger point development is supported by the hypothesis that some motor

units remain exited after overuse or injury. These excited muscle fibers can be treated using classical strain/ counterstrain technique, ultrasound therapy and myofascial release technique. The symptoms seen in people with latent MTrp could be explained by the energy crisis theory (Simons *et al*., 1999). According to this theory, sustained contractile activity of sarcomeres increases the metabolic demands and also squeezes the rich capillaries networks that supply the nutritional and oxygen needs of that region and decreased blood flow in the muscle at the site of latent trigger (Zhang *et al*., 2008) The combination of increased metabolic demand and impaired metabolic supply produces a local energy crisis. The local hypoxia and tissue energy crisis stimulates production of vasoreactive substances which will sensitize local nocioceptors causing pain.

People with MTrPs often turn to medical consultations and drug therapies, but they also use a variety of alternative approaches. There are enormous interventional approaches in treating MTrPs using various electrotherapy modalities and variety of manual therapies.

This study was conducted to compare the effectiveness of classical strain / counterstrain technique with ultrasound therapy and myofascial release technique with ultrasound therapy on unilateral upper trapezius trigger points.

Strain/couterstrain is typically used to treat orthopedic disorders involving pain, fascial tension, local edema, joint hypomobility, muscle spasm, muscle dysfunction or weakness. Several studies investigating SCS report decreased pain or palpation tenderness.

The pre-treatment assessment was taken by using the following outcome measures: VAS, NDI, CROM, and their assessment was taken on 1st and post-treatment assessment was taken on 5th day respectively.

This study comprising of 60 subjects with unilateral upper trapezius trigger points were selected with age ranging from 20yrs to 40yrs and divided into Group A and Group B respectively, each consisting of 30 patients.

Group A, will be treated with strain/counterstrain technique with ultrasound therapy consisting of 30 patients, in which 15 males (50%) and 15 females (50%)

Group B, treated with myofascial release technique with ultrasound therapy consisting of 30 patients in which 16males (53.3%) and 14females (46.7%).

There were 13 patients (43.3%) in group A and 23 patients (76.7%) in group B with their age group between 20 to 30 years. The age group between 31 to 40 years has 17 patients (56.7%) and 7 (23.3%) in group A and group B respectively.

Further the researcher have used VAS scale (for the assessment of pain) as the first outcome measure for both the groups, where the researcher found that there is significant improvement in Group A patients whose pre-test mean value was 6.87 and this decreased to mean value of 2.53 by the end of 5th day with $p<0.0001$. The Group B pre-test mean value was 6.67 and decreased to a mean value of 3.6 by the end of 5th day with $p<0.0001$.

Further the researcher have used Neck Disability index(for the assessment of functional disability of the neck region caused due to the MTrPs) as second outcome measure for both the groups, where the researcher found that there is significant improvement in both the groups, but the patients with Group A found to have statistically more improvement in NDI score, pre-test mean value of 40.27 on Day 1 and decreased to 15.33 by the end of 5th day with $p<0.0001$, whereas Group B pre-test mean value was 38.7 on Day 1 and decreased to 20.13 by the end of 5th day with $p<0.0001$.

Further the researcher have used Universal Goniometer (for the assessment of active cervical lateral flexion range of motion) as third outcome measure for both the groups, where the researcher found that there is significant improvement in both the groups, but the patients with Group A found to have statistically more improvement in active cervical lateral flexion ROM, pre-test mean value of 33.83 on Day 1 and increased to 42.67 by the end of 5th day with $p<0.0001$,whereas Group B patients for active cervical lateral flexion range of motion pre-test mean value was 35.03 on Day 1 and increased to 41.9 by the end of 5th day with $p<0.0001$.

Assessment of passive cervical lateral flexion range of motion for both the groups, where the researcher found that there is significant improvement in both the groups, but the patients with Group A found to have statistically more improvement in active cervical lateral flexion ROM, pre-test mean value of 39 on Day 1 and increased to 44.23 by the end of 5th day with $p<0.0001$,whereas Group B patients for passive cervical lateral flexion range of motion pre-test mean value was 39.1 on Day 1 and increased to 43.4 by the end of 5th day with $p<0.0001$.

The comparison between Group A and Group B, the VAS score. With the mean value of 4.33 in Group A and mean value of 3.07 in Group B where in the p value was <0.0001 which is considered to be extremely statistically significant.

The comparison between Group A and Group B, the NDI score. With the mean value of 24.93 in Group A and mean value of 19.57 in Group B where in the p value was 0.002 which is considered to be very statistically significant.

The comparison between Group A and Group B, the Active CROM. With the mean value of 8.57 in Group A and mean value of 6.87 in Group B where in the p value was 0.0323 which is considered to be statistically significant.

The comparison between Group A and Group B, the Passive CROM. With the mean value of 5.2 in Group A and mean value of 4.3 in Group B where in the p value was 0.048 which is considered to be statistically significant.

This Study implies that both classical strain/counterstrain technique with ultrasound therapy and myofascial release technique with ultrasound therapy are effective.

Clinically Group A with age group between 20yrs to 40yrs showed better improvement in VAS, NDI and Cervical lateral flexion ROM Group B with age group between 20 to 40yrs showed better improvement in VAS, NDI and Cervical lateral flexion ROM, whereas statistically Group A is found to be more effective than Group B in VAS, NDI and Cervical lateral flexion ROM.

Limitations of the study

1. Sample size is small.
2. The technique requires good communication and concentration for both patient and therapist.
3. Cervical rotation, flexion and extension ROM was not evaluated in the study.
4. In this study, treatment session was of shorter duration.

Suggestions and further recommendation

- In this study, subjects were tested for pain and functional disability and Cervical Lateral flexion ROM; similar studies could also be done to detect the Cervical rotation, flexion and extension ROM
- Further studies should be conducted in larger sample size.
- As the treatment session was done only for a shorter duration, further study should be conducted with long term follow up sessions to know the effectiveness of the treatment.

Conclusion

This study was conducted to compare the effectiveness of classical strain /counterstrain technique with ultrasound therapy and myofascial release technique with ultrasound therapy on unilateral upper trapezius trigger points, the subjects of both groups showed improvement in their VAS,NDI,CROM but group A showed statistically more improvement when compared with group B with the $p<0.005$** value. In this study visual analogue scale, Neck Disability Index Scale (NDI) and CROM were used to measure the pain intensity, functional disability and range of motion of cervical region in case of unilateral upper trapezius trigger points. Taking into consideration the parameters and using the mean score of pain, VAS, NDI, CROM in classical strain /counterstrain technique with ultrasound therapy and myofascial release technique with ultrasound therapy. Since the mean score of VAS, NDI, CROM showed improvement in both the groups. But Group A; classical strain /counterstrain technique with ultrasound therapy showed better improvement when compared with Group B; myofascial release technique with ultrasound therapy. Hence, classical strain /counterstrain technique with ultrasound therapy is better than myofascial release technique with ultrasound therapy. This study was intended to find and compare the effects of classical strain/counterstrain technique with ultrasound therapy and myofascial release technique with ultrasound therapy in patients with unilateral upper trapezius trigger points. 60 patients of both male and female with unilateral upper trapezius trigger points belonging to the age group of 20-40 years were selected for the study that fulfilled the inclusion and exclusion criteria and were divided into 2 groups.

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