



“EFFECTIVENESS OF FOAM ROLLER EXERCISE V/S TENNIS BALL MASSAGE ON PAIN AND RANGE OF MOTION OF NECK IN PATIENTS WITH BILATERAL UPPER TRAPEZIUS MUSCLE SPASM: A COMPARATIVE STUDY”

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ABSTRACT

BACKGROUND – Trapezius muscle spasm is most common cause of neck pain in adult population due to the awkward posture during work and stress. It causes the restriction in cervical range of motion. In recent years, self-myofascial release [SMFR] technique is very popular and alternative technique used to improve muscle flexibility. There are various common SMFR tools used which are foam roller, roller massager and tennis ball massage. This are the easy and less costly, effective technique. However, the efficacy of the technique in patients with bilateral upper trapezius muscle spasm patients is not clear.

AIM- To compare the effectiveness of foam roller exercise and tennis ball massage in bilateral upper trapezius muscle spasm patients.

METHOD – Forty patients were randomly divided into two groups; group A(n=20) and group B(n=20). Group A received foam roller exercise and group B received tennis ball massage and both groups were given static stretching as a conventional treatment. The treatment protocol was set for 2 weeks (6 days/week). Visual analogue scale (VAS) and goniometry for lateral cervical range of motion (ROM) outcome measures were taken both at the baseline and after 2 weeks of treatment.

RESULT– Tennis ball massage showed significant difference in pain and cervical range of motion in patients with bilateral upper trapezius muscle spasm than foam roller exercise. Post right & left VAS score after performing tennis ball massage in bilateral upper trapezius muscle spasm patients was significantly smaller than foam roller exercise ($p < 0.001$). Post right & left cervical ROM after performing tennis ball massage in bilateral upper trapezius muscle spasm patients was significantly higher than foam roller exercise ($p < 0.001$).

CONCLUSION- This study supported alternate hypothesis i.e., we found a significant difference between effects of foam roller exercise and tennis ball massage in bilateral upper trapezius muscle spasm patients. This study concluded that, tennis ball massage is more effective than foam roller exercise in bilateral upper trapezius muscle spasm patients.

KEYWORDS – Neck pain, Bilateral trapezius spasm, Foam roller, Tennis ball massage, Self-myofascial release technique, Static stretching, VAS, Universal goniometer.

I. INTRODUCTION

Trapezius is a large superficial muscle which covers the upper half of the back. Trapezius muscle has three fibres: upper, middle and lower. Trapezius muscle originates from the external occipital protuberance to the lower thoracic vertebrae and inserts to the lateral one-third of the clavicle, acromion process and the spine of the scapula. Upper trapezius fibres elevate the scapula, middle fibres retract the scapula; lower fibres depress the scapula and upper and lower fibres together rotates the scapula. Trapezius helps to steady the scapula. It also extends and laterally flexes the head and neck. Nerve supply of the trapezius muscle is accessory nerve (XI) and ventral rami of (C3, C4).^[1,2]

In adult 20–30 years of age group, complain of neck pain because of their computer-desk work. Prevalence of severe tenderness is more common in women than men with 23% & 7% respectively.^[3] Some studies underline the fact that anxiety and depression are prevalent in chronic neck pain patients.^[4] Due to the neck pain, office workers start to adapt postural changes which leads to the

shortening of upper trapezius muscle and then muscle goes into the spasm condition. It also has bad impact on activities of daily living. It affects their quality of life and person become very stressful and develops irritation towards their work and family.

Neck pain is the most common clinical feature of upper trapezius muscle spasm. It also restricts the neck range of motion [ROM]. Approximately 20% of adult population is suffering from subacute to chronic trapezius spasm which is higher in women than men population.^[5] The upper trapezius muscle spasm commonly seen in desk office workers health-professional workers and drivers.^[6] Muscle spasm is defined as the persistent muscle contraction that cannot be voluntarily released.^[7] Due to poor ergonomics the upper trapezius muscle creates shortness in the muscle length. The trapezius muscle also gets activated by the stressful thoughts and feeling or abnormal breathing pattern.

Repeated overuse of the muscle which may be due to certain activities may lead to this hyper contracture.^[8] During the muscle activity sarcomere in the muscle is overused which leads to increase in muscle tension. Muscle tension converts into the taut band which constricts the blood flow to the muscle. Decrease in oxygen supply to the muscle disturbs the mitochondrial energy metabolism which reduces ATP. This leads to the distress and inhibition of nociceptors (pain receptors) and leads to pain in the muscle.^[9] Application of prolonged pressure to the muscle belly leads to the relaxation of muscle. It helps to decrease ischemia by improving blood circulation to the muscles which reduces parasympathetic activity by releasing relaxation hormones and endorphins decreasing neuromuscular excitability of muscle and minimize pain and muscle spasm.

Pharmacologically trapezius spasm can be treated by giving analgesics and skeletal muscle relaxants. Along with pharmacological treatment, physiotherapy shows significantly reduction in trapezius spasm symptoms. There are several physiotherapy techniques are effective in trapezius spasm patients like hydrocollator pack, transcutaneous electrical nerve stimulation, interferential therapy, muscle energy technique, myofascial release technique, stretching, etc.

Stretching is a general term used to describe any therapeutic maneuver designed to increase soft tissue extensibility with the intent of improving flexibility and range of motion by elongating structure that have adaptively shortened and have become hypomobile. There are various types of stretching are present like static stretching, cyclic or intermittent stretching, ballistic stretching, manual stretching, self-stretching, etc. Static stretching is useful to improve flexibility of the muscle and joint range of motion. Stretching is indicated in tissue extensibility, to improve ROM of the joint, to treat muscle weakness or spasm.^[10,11,12]

In recent years, new concept is very popular which is self-myofascial release technique [SMFR]. Self-myofascial release is an alternative modality that has proven to increase flexibility of muscle. Benefits of SMFR is to increase flexibility of muscle, to reduce arterial stiffness and improve blood circulation and improve vascular endothelial function and to reduce stiffness. Now SMFR is most common method used to treat soft tissue injuries. In recent researches SMFR show high impact of effectiveness in rehabilitation and strength and conditioning fields to aid recovery and increase in joint range of motion.^[13,14,15,16]

There are some common SMFR tools are been used which are foam rollers, roller massager and tennis ball massager. Foam rollers are available in various sizes and foam densities. There are two types of sizes of foam roller are available in market: standard [6inch X 36inch] and half size [6inch X 18inch]. While using the foam roller patient uses their bodyweight to apply soft tissues during the rolling motion.^[17]

Tennis ball is most convenient aid used for self-massage. The tennis ball can be placed on the floor or a wall any other part to apply definite pressure on the tight or aching site of the muscle. The main aim of tennis ball massage is to reach the area of the body which cannot be reached with the individuals own hands. The pressure applies by tennis ball should be large enough to release the tightness without irritating nervous system.^[16,18]

There is various size of tennis balls that are used for myofascial release for various places. The tennis ball ranging from 60-65 mm sizes these are meant to be used on the arms, shoulders, chest, hips, legs, back and buttocks against the wall. The tennis ball of 45 mm is useful to sit on to myofascial release the buttocks and pelvic floor muscles or to massage small forearms against a wall. The 35 mm tennis ball is useful for bottom of the feet against the floor or beside the spine against a wall. The 24 mm ball is for hand and the base of the thumb against wall.^[16,18]

There are some previous studies has proven the benefit of foam roller exercises with static stretching improve the muscle flexibility. Some other studies have proven the positive effects of tennis ball massage on pain and improving muscle flexibility. There are currently no literature comparing this both techniques. Hence it is a need of study to compare the foam roller exercise and tennis ball massage in bilateral upper trapezius muscle spasm patients.

II. AIM

To compare the effectiveness of foam roller exercise and tennis ball massage in bilateral upper trapezius muscle spasm patients.

III. OBJECTIVES

- To find out the effectiveness of foam roller exercise in bilateral upper trapezius muscle spasm patients.
- To find out the effectiveness of tennis ball massage in bilateral upper trapezius muscle spasm patients.
- To evaluate the difference between the effectiveness of foam roller exercise and tennis ball massage in bilateral upper trapezius muscle spasm patients.

IV. MATERIAL & METHODOLOGY

Ethical clearance was obtained by the Institutional Ethical Committee, prior to the beginning of the study. The study was conducted on patients with neck pain due to the bilateral upper trapezius muscle spasm age ranging between 20-30 years old population. The sample size was 40. Data was obtained from the tertiary care unit in Miraj. The goal of the study was explained to the patients into their vernacular language. Each participant was screened according to the inclusion and exclusion criteria. Inclusion criteria of the study was patient with the bilateral upper trapezius muscle spasm, neck pain on VAS score above 5 out of 10. Exclusion criteria of the study was patients with neck pain radiating to Upper limb, cervical spine pathology, cervical vertebrae fracture and patients who have undergone surgeries in and around the cervical spine. Patients were allotted into two groups, group A (n=20) and group B(n=20) with randomized clinical trial method. Consent form was taken by the selected patients. Group A received foam roller exercise and group B received tennis ball massage. Pre interventional VAS score and lateral cervical range of motion by goniometry were recorded. After 2 weeks of treatment protocol for both the groups, data was recorded and analyzed.

V. PROCEDURE

For group A, position of the patient was in supine lying with hips and knees are flexed and foam roller was placed below the occiput. Patient was instructed to rest head and neck on the foam roller and arms alongside. Then with both the feet planted on the ground, we asked them to lift buttock up to apply pressure to the upper trapezius muscle and inhale. A straight line was formed from shoulder to knees, with belly button squeezed in tight to spine. Three repetitions of 1minute duration with 30 seconds of rest in each repetition.^[22,23]



Figure 1- starting position of foam roller exercise



Figure 2 - foam roller exercise

For group B, position of the patient was in supine lying with hips and knees flexed and tennis ball was placed at the C₇-T₁ vertebrae level. Patient was instructed to lie down in supine position with hips and knees flexed. Then with both feet planted on ground, we asked the patient to lift buttocks up to apply pressure to the upper trapezius muscle. A straight line was formed from shoulder to knees with belly button squeezed in tight to spine. Three repetitions of 1 minute duration with 30 seconds of rest in each repetition and same procedure repeated at the other side.^[22,23]



Figure 3 - starting position of tennis ball massage



Figure 4 - Tennis ball massage

As a conventional treatment we gave the static stretching in both the groups after the exercise. For static stretching patient was in sitting position and therapist was standing behind the patient. One hand of the therapist was placed over the shoulder and another was placed above the ear on the head of involved side. Duration of stretch 20 seconds, with 3 repetitions and 10 seconds of rest period in each stretch.^[10]



Figure 5 - Figure of static stretching

VI. STATISTICAL ANALYSIS

Data was analyzed for group A and group B with paired t-test and for comparison between both the groups unpaired t-test was used.

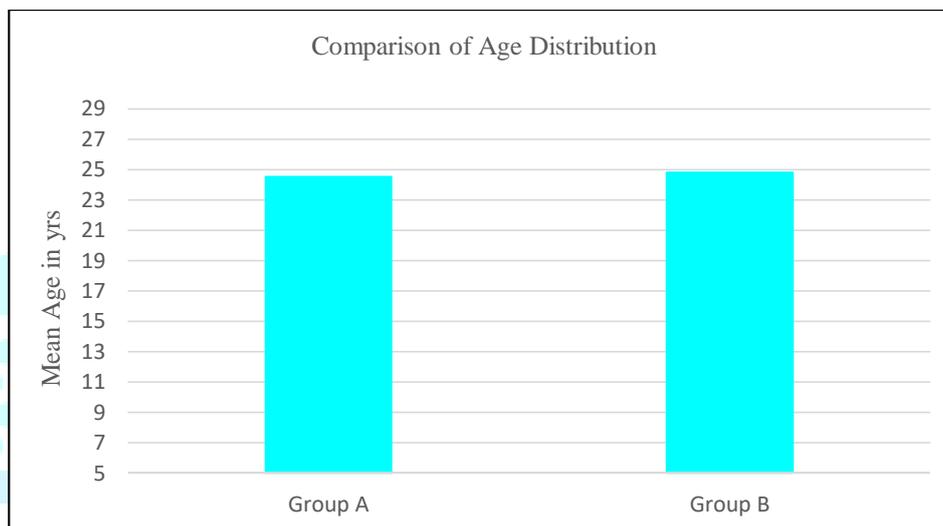
VII. RESULT

Group A: Foam roller exercise

Group B: Tennis ball massage

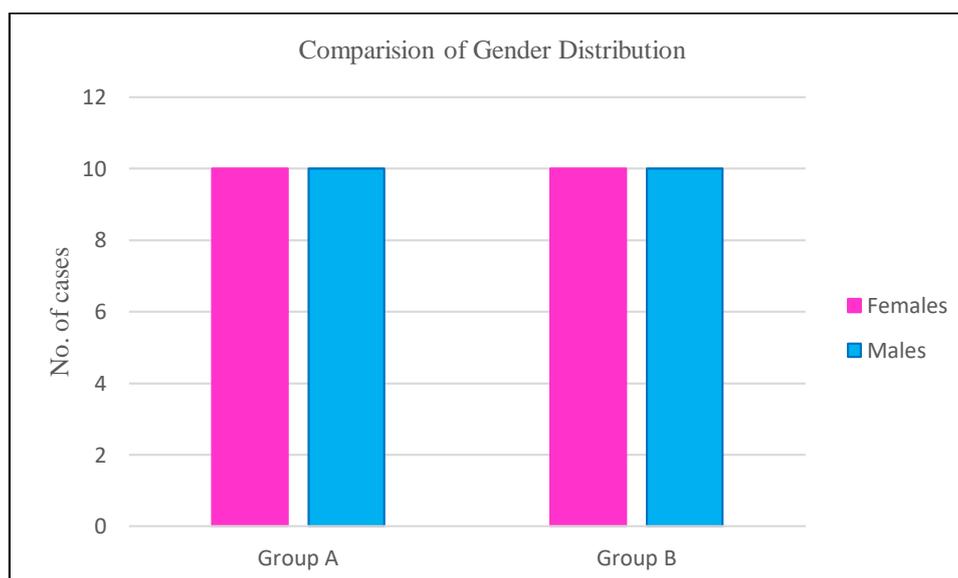
Table 1: Demographic data

Age in years	N	Mean	Std. Deviation
Group A	20	24.50	2.63
Group B	20	24.80	2.48



Graph 1: Age wise distribution of patients in two groups

Gender	Females	Males	Total
Group A	10	10	20
Group B	10	10	20



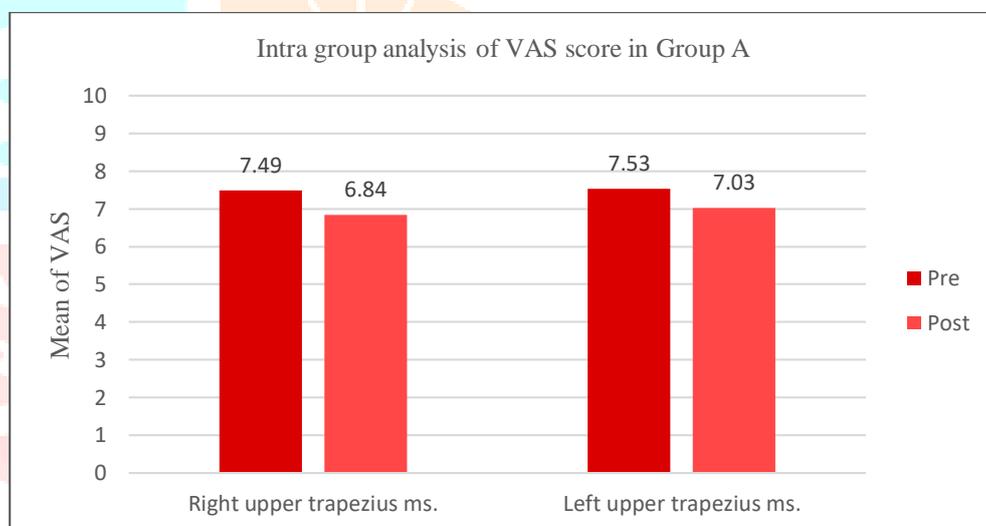
Graph 2: Gender wise distribution of subjects in two groups

Interpretation: The mean age of the patients in the age group of 20-30 years in Group A was 24.50 (SD=2.63) and Group B was 24.8 (SD=2.48). The proportion of female patients (50%) & male patients (50%) was equal in both the groups as shown in the graph.

Table 2: Intra group analysis of VAS score in Group A

Group A					
Right Side	Mean	SD	t value	p value	Result
Pre	7.49	0.86	17.97	<0.001	HS
Post	6.84	0.83			

Group A					
Left Side	Mean	SD	t value	p value	Result
Pre	7.53	1.06	13.26	<0.001	HS
Post	7.03	1.02			



Graph 3: Graph of intragroup analysis of mean of VAS in Group A

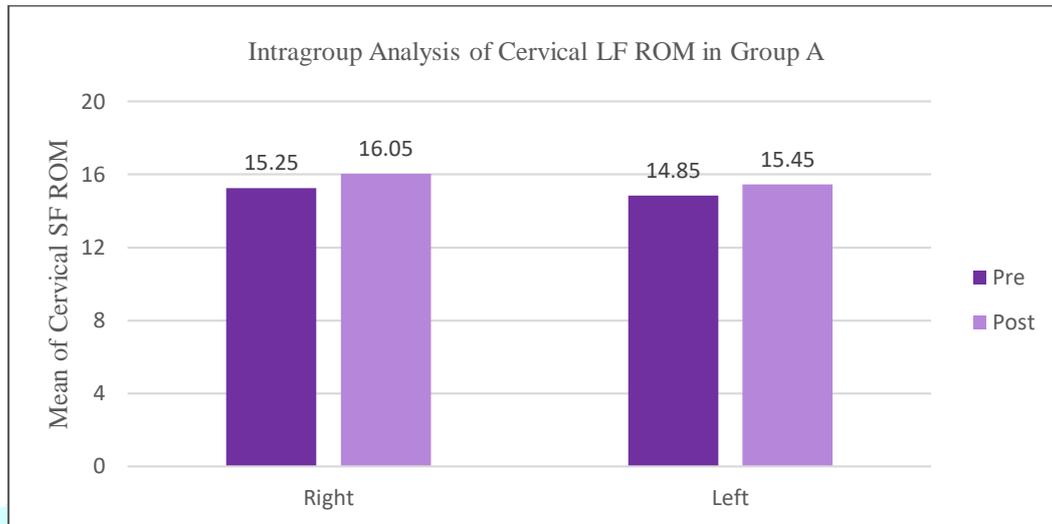
Interpretation: The intragroup analysis of VAS score in Group A on right side shows highly significant results, post intervention mean VAS score 6.84 (SD=) was significantly smaller than pre intervention mean VAS score 7.49 (SD=). The t value 17.97 and p value in the result is 0.001 which is less than 0.05 (i.e. $p < 0.05$) shows statistically significant result in reducing post intervention pain on right side.

The intragroup analysis of VAS score in Group A on left side shows highly significant results, post intervention mean VAS score 7.03 (SD=) was significantly smaller than pre intervention mean VAS score 7.53 (SD=). The t value 13.26 and p value in the result is 0.001 which is less than 0.05 (i.e. $p < 0.05$) shows statistically significant result in reducing post intervention pain on left side.

Table 3 – Intragroup analysis of Cervical Lateral Flexion ROM of group A

Group A					
Right side	Mean	Std. Deviation	t value	p value	Result
Pre	15.25°	2.61°	5.81	<0.001	HS
Post	16.05°	2.56°			

Group A					
Left side	Mean	Std. Deviation	t value	p value	Result
Pre	14.85°	2.89°	4.49	<0.001	HS
Post	15.45°	3.07°			



Graph 4: Graph of Intra-group analysis of mean of Cervical LF ROM in Group A

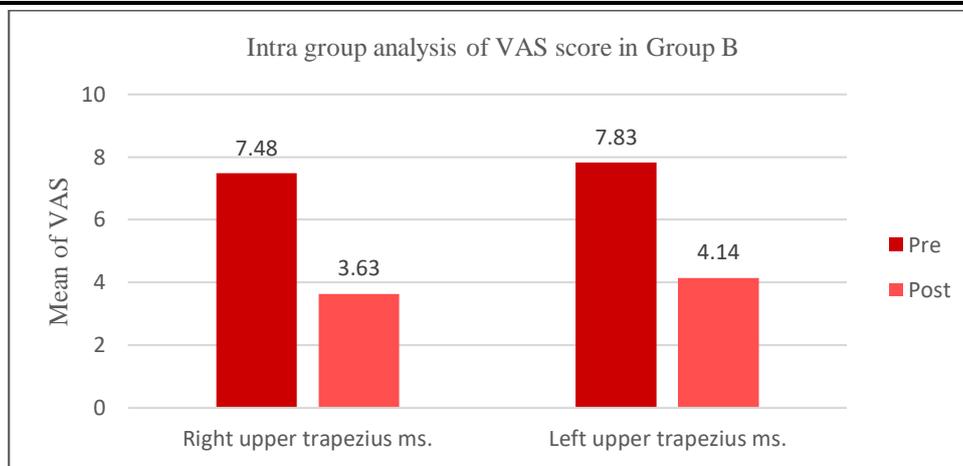
Interpretation: The intragroup analysis of Cervical Lateral Flexion ROM in Group A on right side shows highly significant results, post intervention mean of Cervical SF ROM 16.05 (SD=) was significantly higher than pre intervention mean of Cervical SF ROM 15.25 (SD=). The t value 5.81 and p value in the result is 0.001 which is less than 0.05 (i.e. $p < 0.05$) shows statistically significant result in improving post intervention Cervical SF ROM on right side.

The intragroup analysis of Cervical Lateral Flexion ROM in Group A on left side shows highly significant results, post intervention mean of Cervical SF ROM 15.45 (SD=) was significantly higher than pre intervention mean of Cervical SF ROM 14.85 (SD=). The t value 4.49 and p value in the result is 0.001 which is less than 0.05 (i.e. $p < 0.05$) shows statistically significant result in improving post intervention Cervical SF ROM on left side.

Table 4: Intra group analysis of VAS score in Group B

Group B					
Right Side	Mean	SD	t value	p value	Result
Pre	7.48	0.67	20.92	<0.001	HS
Post	3.63	0.77			

Group B					
Left Side	Mean	SD	t value	p value	Result
Pre	7.83	1.03	18.38	<0.001	HS
Post	4.14	0.83			



Graph 5: graph of Intra-group analysis of mean of VAS score in Group B

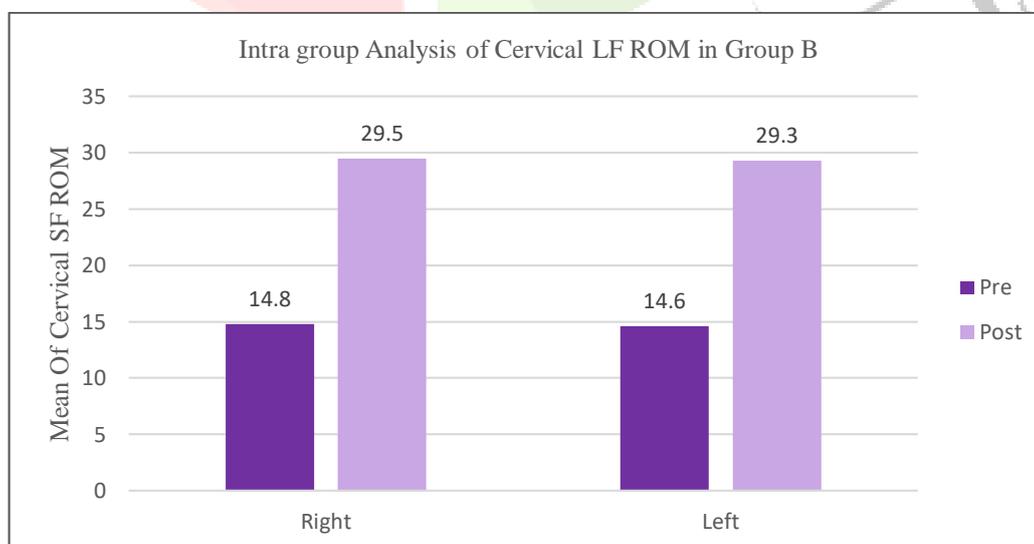
Interpretation: The intragroup analysis of VAS score in Group B on right side shows highly significant results, post intervention mean VAS score 3.63 (SD=) was significantly smaller than pre intervention mean VAS score 7.48 (SD=). The t value 20.92 and p value in the result is 0.001 which is less than 0.05 (i.e. $p < 0.05$) shows statistically significant result in reducing post intervention pain on right side.

The intragroup analysis of VAS score in Group B on left side shows highly significant results, post intervention mean VAS score 4.14 (SD=) was significantly smaller than pre intervention mean VAS score 7.83 (SD=). The t value 18.38 and p value in the result is 0.001 which is less than 0.05 (i.e. $p < 0.05$) shows statistically significant result in reducing post intervention pain on left side.

Table 5 – Intragroup Analysis of Cervical Lateral Flexion ROM of group B

Group B					
Right side	Mean	Std. Deviation	t value	p value	Result
Pre	14.8°	1.88°	21.59	<0.001	HS
Post	29.5°	3.00°			

Group B					
Left side	Mean	Std. Deviation	t value	p value	Result
Pre	14.6°	3.08°	19.58	<0.001	HS
Post	29.3°	3.84°			



Graph 6: Graph of Intra-group Analysis of mean of Cervical LF ROM in Group B

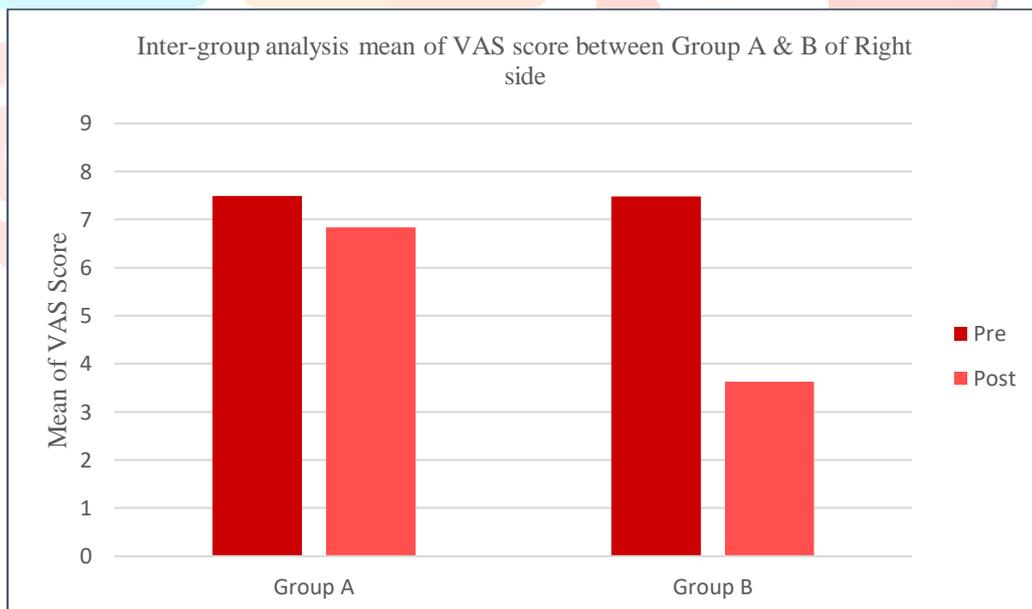
Interpretation: The intragroup analysis of Cervical Lateral Flexion ROM in Group B on right side shows highly significant results, post intervention mean of Cervical SF ROM 29.5 (SD=) was significantly higher than pre intervention mean of Cervical SF ROM 14.8 (SD=). The t value 21.59 and p value in the result is 0.001 which is less than 0.05 (i.e. $p < 0.05$) shows statistically significant result in improving post intervention Cervical SF ROM on right side.

The intragroup analysis of Cervical Lateral Flexion ROM in Group A on left side shows highly significant results, post intervention mean of Cervical SF ROM 29.3 (SD=) was significantly higher than pre intervention mean of Cervical SF ROM 14.6 (SD=). The t value 19.58 and p value in the result is 0.001 which is less than 0.05 (i.e. $p < 0.05$) shows statistically significant result in improving post intervention Cervical SF ROM on left side

Right Side	Mean with SD (Pre)	Mean with SD (Post)	t value	p value
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Table 6: Inter group analysis mean of VAS score between A & B group of Right side

Right Side	Mean with SD(Pre)	Mean with SD (Post)	T value	P value
Group A	7.49 0.86	6.84 0.83	17.97	<0.001 HS
Group B	7.48 0.67	3.63 0.77	20.92	<0.001 HS
Unpaired T test value	0.02	12.69		
P value	0.98 NS	<0.001 HS		

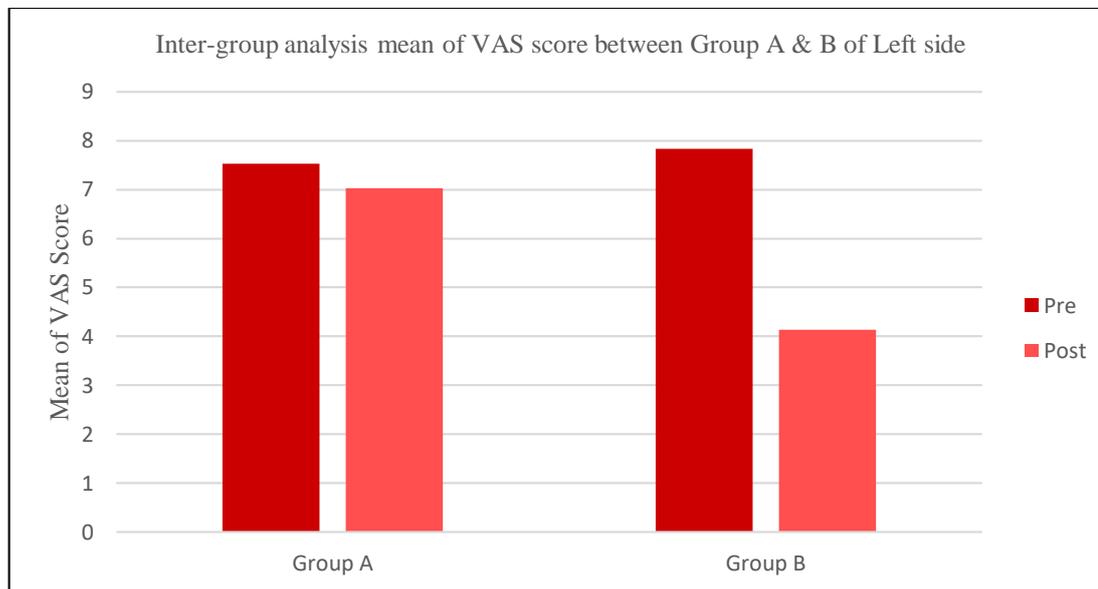


Graph 7: Graph of Inter-group analysis mean of VAS score between Group A & B of Right side

Interpretation: The inter-group analysis pre interventional mean of VAS score in group A & B on right side shows no significant difference, with baseline measurement mean score of group A 7.49 (SD=0.86), group B 7.48 (SD=0.67). The unpaired t test value is 0.02 and p value 0.98 which is more than 0.05 (i.e. > 0.05). The post interventional mean of VAS score in group A 6.84 (SD=0.83), group B 3.63 (SD=0.77). The unpaired t test value is 12.69 and p value in the result is 0.001 which is less than 0.05 (i.e. $p < 0.05$) showing statistically highly significant results in reducing the post intervention measurement of VAS score on right side.

Table 7: Inter group analysis mean of VAS score between A & B group Left side

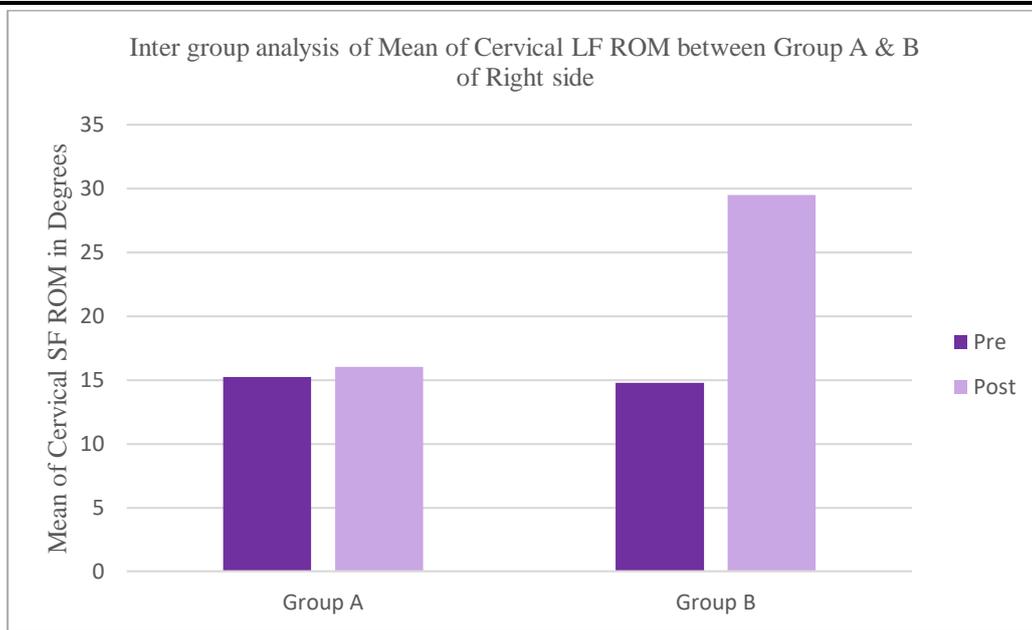
Group A	7.53 1.06	7.03 1.02	13.26	<0.001 HS
Group B	7.83 1.03	4.14 0.83	18.38	<0.001 HS
Unpaired T test value	0.92	9.77		
P value	0.36 NS	<0.001 HS		

**Graph 8: Graph of inter-group analysis mean of VAS score between group A&B of Left side**

Interpretation: The inter-group analysis pre interventional mean of VAS score in group A & B on left side shows no significant difference, with baseline measurement mean score of group A 7.53 (SD=1.06), group B 7.83 (SD=1.03). The unpaired t test value is 0.92 and p value 0.36 which is more than 0.05 (i.e.>0.05). The post interventional mean of VAS score in group A 7.03 (SD=1.02), group B 4.14 (SD=0.83). The unpaired t test value is 9.77 and p value in the result is 0.001 which is less than 0.05 (i.e. p<0.05) showing statistically highly significant results in reducing the post intervention measurement of VAS score on left side.

Table 8: Inter group analysis mean of Cervical LF ROM between A & B group Right side

Right Side	Mean with SD (Pre)	Mean with SD (Post)	t value	P value
Group A	15.25° 2.61°	16.05° 2.56°	5.81	<0.001 HS
Group B	14.80° 1.88°	29.50° 3.00°	21.59	<0.001 HS
Unpaired t test value	0.63	15.24		
P value	0.54	<0.001 HS		

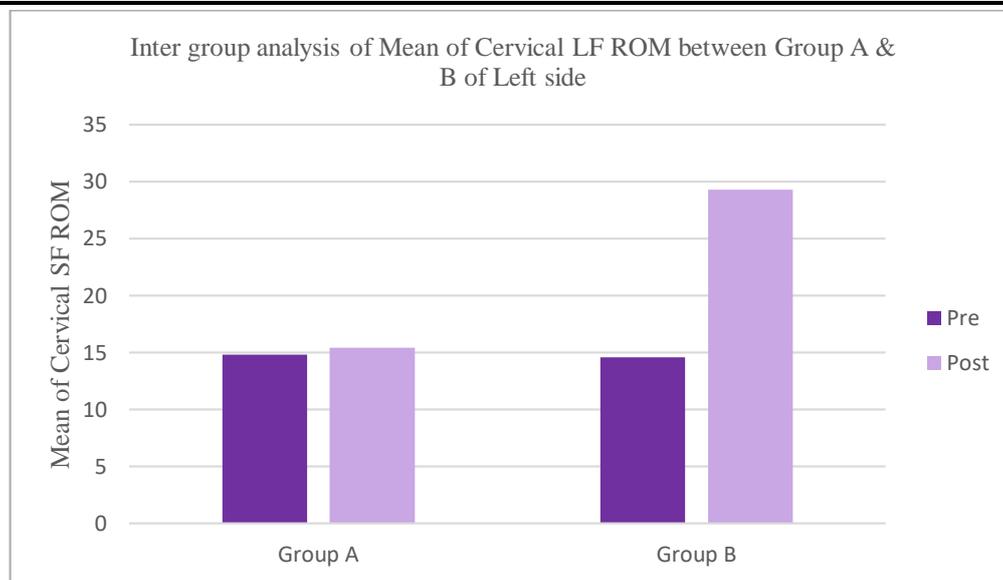


Graph 9: Inter group analysis of Mean of Cervical LF ROM between Group A & B of Right side

Interpretation: The inter-group analysis pre interventional mean of Cervical SF ROM in group A & B on right side shows no significant difference, with baseline measurement mean score of group A 15.25° (SD=2.61°), group B 14.80°(SD=1.88°). The unpaired t test value is 0.63 and p value 0.54 which is more than 0.05 (i.e.>0.05). The post interventional mean of Cervical SF ROM in group A 16.05° (SD=2.56°), group B 29.5° (SD=3.00°). The unpaired t test value is 15.24 and p value in the result is 0.001 which is less than 0.05 (i.e. p<0.05) showing statistically highly significant results in improving the post intervention Cervical SF ROM on right side.

Table 9: Inter group analysis mean of Cervical LF ROM between A & B group Left side

Left Side	Mean with SD (pre)	Mean with SD (post)	t value	p value
Group A	14.85° 2.88°	15.45° 3.07°	4.49	<0.001 HS
Group B	14.60° 3.08°	29.30° 3.84°	19.58	<0.001 HS
Unpaired T test value	0.27	12.60		
P value	0.79	<0.001 HS		



Graph 10: Inter group analysis of Mean of Cervical LF ROM between Group A & B of Left side

Interpretation: The inter-group analysis pre interventional mean of Cervical SF ROM in group A & B on left side shows no significant difference, with baseline measurement mean score of group A 14.85° ($SD=2.88^{\circ}$), group B 14.60° ($SD=3.08^{\circ}$). The unpaired t test value is 0.27 and p value 0.79 which is more than 0.05 (i.e. >0.05). The post interventional mean of Cervical SF ROM in group A 15.45° ($SD=3.07^{\circ}$), group B 29.30° ($SD=3.84^{\circ}$). The unpaired t test value is 12.60 and p value in the result is 0.001 which is less than 0.05 (i.e. $p<0.05$) showing statistically highly significant results in improving the post intervention Cervical SF ROM on left side.

VIII. DISCUSSION

This study was designed to compare the effectiveness between foam roller exercises and tennis ball massage in patients with bilateral upper trapezius muscle spasm. Neck pain is the most common clinical feature of upper trapezius muscle spasm. It also restricts the neck range of motion [ROM]. Gerdle B *et.al* performed a study on chronic musculoskeletal pain, in which they found that approximately 20-30% of adult population is suffering from subacute to chronic trapezius spasm which is higher in women than men population.^[5] Present study tried to compare effectiveness between foam roller exercises and tennis ball massage on neck pain and lateral cervical range of motion in patients with bilateral upper trapezius muscles spasm. This experimental study was conducted in patients with non-radiating neck pain.

In adult 20-30 years of age group, complain of neck pain because of their computer-desk work. Prevalence of severe tenderness is more common in women than men with 23% & 7% respectively^[3] Chaudhary E *Set.al* performed their study on predominance of women with dominant side (Dominant- 60%; NonDominant-40%), with middle age range participants in this study reflects the characteristics of population that is likely to experience upper trapezius muscle spasm.^[6] As an outcome measure, we took VAS to measure neck pain and to measure the cervical lateral flexion, we took universal goniometry. Boonstra AM *et.al* performed a study to evaluate the reliability and validity of a visual analogue scale (VAS) for disability as a scale measuring disability in chronic musculoskeletal pain patients was the objective of the study [$r=0.64-0.84$]^[20]. de Koning CH *et.al* conducted a study to provide knowledge regarding different kinds of goniometers that can be used in daily practice to measure active cervical range of motion (ACROM) in patients with non-specific neck pain [$ICC > 0.75$]^[21].

In foam roller exercise, pre intervention and post intervention was done by the paired t-test. Post right VAS score (6.84) i.e. after performing foam roller exercises in bilateral upper trapezius muscle spasm patients was significantly smaller than pre right VAS score (7.49) ($p<0.001$). Post left VAS score (7.03) i.e. after performing foam roller exercises in bilateral upper trapezius muscle spasm patients was significantly smaller than pre left VAS score (7.53) ($p<0.001$). Post right cervical ROM score (16.05°) i.e. after performing foam roller exercises in bilateral upper trapezius muscle spasm patients was significantly higher than pre right cervical ROM score (15.25°) ($p<0.001$). Post left cervical ROM score (15.45°) i.e. after performing foam roller exercises in bilateral upper trapezius muscle spasm patients was significantly higher than pre left cervical ROM score (14.85°) ($p<0.001$).

According to some researches, foam roller helps to improve the joint ROM. Dr. Sharayu Agré *et.al*, their study clarifies that when foam roller exercise is combined with static stretching, it showed significantly positive response in improving joint ROM and muscle flexibility. A foam roller is combined with static stretching has shown positive therapeutic effect. The foam roller can be used by the patient by themselves, using their own weight mechanical friction gets created between foam roller and superficial and deep layers of soft tissue which stimulates the primarily mast cells and produce histamine [which is a vasodilator]. Vasodilation increases the blood flow to the area treated and allows quicker and more complete diffusion of waste products from tissue to the blood. This action helps to increase intramuscular tissue temperature and blood flow, together this effect helps to increase in viscoelastic properties of muscle. Constant stretch increases the tissue length and also helps to decrease internal tension in the tissue. Some theories used to explain is that when undisturbed fascia becomes more viscous, solid form can restrict movement. The heat generated from rolling friction, mechanical stress, massaging pressure is applied to the fascia, it can become more gel-like and pliable, allowing it greater flexibility, in turn, increases ROM.^[1] Researcher Daniel Junker also proved that foam roller is an excellent tool to improve hamstring muscle flexibility with 4 weeks of treatment protocol.^[19] Škarabot J *et.al* performed a study to find out the effectiveness of self-myofascial release technique with static stretching in ankle joint ROM in adolescent athletes and in their study they found a significant result in improving ankle ROM.^[26] Our study result support above articles, it shows significant

difference between VAS and ROM of cervical spine in group A. There is a slight positive significant was seen in reduction of pain and increase in cervical ROM.

In tennis ball massage, pre intervention and post intervention was done by the paired t-test. Post right VAS score (3.63) i.e. after performing tennis ball massage in bilateral upper trapezius muscle spasm patients was significantly smaller than pre right VAS score (7.48) ($p < 0.001$). Post left VAS score (4.14) i.e. after performing tennis ball massage in bilateral upper trapezius muscle spasm patients was significantly smaller than pre left VAS score (7.83) ($p < 0.001$). Post right cervical ROM score (29.5°) i.e. after performing tennis ball massage in bilateral upper trapezius muscle spasm patients was significantly higher than pre right cervical ROM score (14.8°) ($p < 0.001$). Post left cervical ROM score (29.3°) i.e. after performing tennis ball massage in bilateral upper trapezius muscle spasm patients was significantly higher than pre left cervical ROM score (14.6°) ($p < 0.001$).

As per the researcher Dr. Anagha Kadam **et.al**, stated that in their study self-myofascial release using tennis ball helps in reducing pain and increasing pain pressure threshold providing a simple yet effective alternative for piriformis trigger points pain. Application of prolonged pressure to the muscle belly leads to the relaxation of muscle. It helps to decrease ischemia by improving blood circulation to the muscles which reduces parasympathetic activity by releasing relaxation hormones and endorphins decreasing neuromuscular excitability of muscle and minimize pain and muscle spasm.^[18] Another research also showed that, The results of this present study indicated that a single treatment of bilateral SMR to the plantar aspect of each foot resulted in an immediate increase in hamstring and lumbar spine flexibility as indicated by an increase in SRT scores.^[24] According to some theories applying pressure to trigger points appears to cause the Golgi tendon organ (GTO) complex bring out an inhibitory effect on the muscle, allowing it to become less tense and more pliable, leading to an increase in joint range-of-motion.

Both the groups received static stretching as a conventional treatment. Static stretching is a well-accepted as an effective form of stretching to increase flexibility. The static stretching technique needs assistance. While giving static stretching soft tissues get elongated which reduces the tissue resistance and then held in the lengthened position with a sustained stretch. According to some theories, during static stretching it is thought that the GTO, which monitors tension created by stretch of a muscle-tendon unit, may contribute to muscle elongation by overriding any facilitative impulses from the primary afferents of the muscle spindle (Ia afferent fibres) and may contribute to muscle relaxation by inhibiting tension in the contractile units of the muscle being stretched.^[1,10]

Unpaired t test was done to evaluate the difference between the effectiveness of foam roller exercises and tennis ball massage in bilateral upper trapezius muscle spasm patients. It was found that: Post right VAS score i.e. after performing tennis ball massage (3.63) in bilateral upper trapezius muscle spasm patients was significantly smaller than post right VAS score after performing foam roller exercise (6.84) ($p < 0.001$). Post cervical right ROM score i.e. after performing tennis ball massage (29.50°) in bilateral upper trapezius muscle spasm patients was significantly higher than Post cervical right ROM score after performing foam roller exercise (16.05°) ($p < 0.001$). Post left VAS score i.e. after performing tennis ball massage (4.14) in bilateral upper trapezius muscle spasm patients was significantly smaller than post left VAS score after performing foam roller exercise (7.03) ($p < 0.001$). Post cervical left ROM score i.e. after performing tennis ball massage (29.30°) in bilateral upper trapezius muscle spasm patients was significantly higher than post cervical left ROM score after performing foam roller exercise (15.45°) ($p < 0.001$).

Hence the present study concludes that tennis ball massage showed more reduction in pain and improvement in lateral flexion of the cervical range of motion than foam roller exercise. While conducting the study we learned some of the common aetiology of upper trapezius muscle spasm in adult population is awkward neck posture, stress and heavy lifting weights on shoulder. The major benefit of the treatment seeing as the treatment can be performed by the individual themselves, according to their need. In our study it was seen that tennis ball massage showed more reduction in pain and improvement in lateral flexion of the cervical range of motion than foam roller exercise. This treatment protocol is beneficial for individuals in their daily hectic life routine with helping them in reducing the pain and improving cervical range of motion, as it is easier and in everyone's budget.

IX. CONCLUSION

This study supported alternate hypothesis i.e., we found a significant difference between effects of foam roller exercise and tennis ball massage in bilateral trapezius spasm patients. This study concluded that, tennis ball massage is more effective than foam roller exercises in bilateral trapezius spasm patients.

X. LIMITATIONS AND SUGGESTIONS

Our study had short duration of treatment protocol. Further study can be done with longer duration of treatment protocol. The study can be done in other age group. Sample size can be improved.

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