The Egyptian Journal of Hospital Medicine (October 2022) Vol. 89, Page 4668- 4675

Effect of Manual Pressure Release and Scapular Stabilization Exercises on Myofascial Pain Syndrome Following Neck Dissection Surgery

Alzahraa Mohammed Mohammed Attia*[1], Nancy Hassan Aboelnour[1], Ragab Ali Sherif[2], Karim Ibrahim Saafaan[1]

[1]Department of Physical Therapy for Surgery, Faculty of Physical Therapy, Cairo University, Egypt

[2]Department of Surgical Oncology, Damanhur Oncology Centre, Egypt

***Corresponding author:** Alzahraa Mohammed Mohammed Attia, **Mobile:** (+20)01060472579,

E-mail: zahra_mohammed56@yahoo.com

ABSTRACT

Background: Neck dissection (ND) is a popular technique to treat malignant growths in the head and neck caused by carcinoma of squamous cells. Spinal accessory nerve damage related to the type of neck dissection surgery (NDS) results in scapular dyskinesia, trapezius atrophy, shoulder dysfunction, and chronic neck pain. Myofascial pain syndrome (MPS) is identified in 13% of individuals with neck and head cancer.

Objective: The aim of the study is to explore the impact of MPR and SSE at MPS following ND surgery in reducing pain and improving cervical ROM. **Patients and methods:** A total of 40 patients with cervical MPS post NDS were enrolled, and divided into 2 equal groups in a random manner. The intervention group (Group A) applied manual pressure release (MPR) for 20 minutes and scapular stabilization exercises (SSE) for approximately 30 minutes, in addition to traditional therapy (ROM exercises, strengthening exercises, and stretching exercises) for about 15 minutes. The control group (Group B) received only traditional therapy. The trial lasted 8 weeks and involved 3sessions per week.

Results: Comparing between the intervention group and the control group after treatment showed that the intervention group had a significantly lower VAS (p=0.001) and a significantly higher pressure pain threshold (p=0.002). Moreover, side bending and rotation ROM of the neck for both sides were significantly improved within the intervention group compared to the control group (p=0.001).

Conclusion Better results were observed within neck pain and ROM in the patients who received MPR and SSE.

Keywords: Neck dissection surgery, Myofascial pain syndrome, Manual pressure release, Scapular stabilization exercise.

INTRODUCTION

Neck dissection (ND) is a surgical operation in which surgeon apply removal of the fibro fatty tissue and the lymphatic of the neck as a management for cervical lymphatic tumor **[1]**. Tumor starts in head and neck then migrate to the lymph nodes in the neck **[2]**. For many head and neck malignancies, excision of cervical lymph nodes is the standard therapy **[3]**. Spinal accessory nerve which coordinates the full range of motion (ROM) of arm and shoulder is particularly sensitive to iatrogenic damage during ND due to its superficial position in the posterior triangle. New techniques have been developed to save spinal accessory nerve **[4]**. Radical neck dissection (RND) is a technique which entails removal of neck whole lymph nodes on one side, internal jugular vein, sternocleidomastoid muscle, and spinal accessory nerve **[5]**.

Furthermore, excision of all lymph nodes normally excised during RND was referred to as modified radical neck dissection (MRND) but keeping one or more non-lymphatic components such as internal jugular vein, spinal accessory nerve, and sternocleidomastoid muscle intact **[3]**. A type of lymphadenectomy known as selective neck dissection (SND) preserves one or even several groups of cervical lymph nodes **[6]**.

Early post-surgical complications that may affect patient are: infection, thrombosis and cardiac problems, while the more well-known late complications are pain and stiffness of neck, ROM restrictions of shoulder, reduction in the width of the mouth's aperture, swallowing problems and lymphedema. Neck morbidity was common after cancer treatment, including pain of neck, feeling loss, and reduced ROM. For at least a year after ND, Shoulder and neck pain can have an adverse influence on a patient's clinical condition and quality of life **[5]**.

After ND, shoulder and neck dysfunction's prevalence and incidence vary depending on the kind of operation and the dysfunctional measurement utilized. Teymoortash and colleagues found that 13% of participants had difficulty turning to the non-operated direction, while 3.8% of participants showed moderate restriction. 11.5% of participants showed slight to moderate restriction during leisure time and everyday activities **[7]**.

Two forms of neck pain were detected in a survey of 25 cases that had persisting pain in the neck post-ND; myofascial and neuropathic pains. Furthermore, symptoms of shoulder and neck were reported in 37% and 33% of the 220 participants who received neck dissection surgery (NDS), respectively, while myofascial and neuropathic pains were reported in 46% and 32% of the patients, respectively **[5]**.

Myofascial pain syndrome (MPS), which typically affects the muscles and manifests as motor, sensory, and autonomic dysfunctional symptoms, Myofascial trigger points (MTrPs) are tender areas of hyper-tense muscle tissue that typically consist of a tight band of skeletal muscle that aches when compressed or deeply

Received: 25/5/2022
Accepted: 2/8/2022

palpated [8]. MTrPs are classified into active and latent trigger points [9].

The MTrPs are triggered when there is pain and tenderness. Muscles that are affected by active MTrPs become weaker and shorter. Clinically, they are identified when a patient feels pain during muscular compression and a local twitch reaction in the muscle fibers is triggered. A latent trigger point is a tender place that causes pain only when pressed; it exhibits all of the clinical features of an active MTrP except for the immediate pain [10].

To diagnose PPT of MPS, pressure algometry can be used [11]. Antidepressants, anticonvulsants, and muscle relaxants are among the medications used to treat MPS, while analgesic non-steroidal anti-inflammatory drugs (NSAIDs) are widely recommended [5, 12]. Non-pharmacological treatments include transcutaneous electrical nerve stimulation (TENS), ultrasound (US), and injection of trigger points and dry needling [13].

Myofascial Release Technique (MFRT) entails applying low-amplitude, long-lasting fascia and muscle stretches with no more than 2 minutes of stimulation in any one area. The goal of MFRT is to preserve tissue elasticity in tissues like fascia that have undergone surgery [14].

Scapular stabilization exercises (SSE) are an important part of the treatment for a variety of pain conditions because they help to keep the scapula in proper alignment and aid in the recovery of muscle and motor function. It enhances a person's coordination when motor control is disrupted, as it maintains balance. It also aids in keeping the humeral head in the glenoid cavity's center and the scapula in the balanced field of the chest, maintaining muscle length all throughout the shoulder joints, reducing improper motion and preventing micro-injuries of muscles which consequently lower trapezius pain [15].

Manual pressure release (MPR) and SSE are thought to be effective in the management of MPS following NDS in terms of enhancing pain relief and cervical ROM as MPR is a direct manual approach which utilizes specifically guided mechanical forces to manipulate and reduce myofascial restrictions of various somatic dysfunctions according to Gate Control Theory, parasympathetic response of the autonomic nervous system, and the release of serotonin theory. When it is used with other treatment modalities, it shows immediate reduction in pain and improvement in ROM in patients with MPS. Therefore, SSE has been added to the treatment program as patients with neck pain report abnormal activity in the trapezius muscle and associated scapular postural changes due to the imbalance of muscles responsible for the scapular position rather than strength deficits. Because scapula dysfunction causes problems in neuromuscular coordination between the cervical and scapular regions, providing a foundation for both upper extremity and cervical region problems, when SSE is added to the treatment program, it provides mobility and functional gain in patients with neck pain. This also could result in a non-invasive, safe, and successful therapy for MPS, in order to prevent invasive procedures and the use of oral drugs that, because of their systemic negative harmful impacts, can't be endured for a long period of time.

The aim of the research is to explore the impact of MPR and SSE at MPS following ND surgery in reducing pain and improving cervical ROM. Based on our knowledge, it is the first study that assessed the combined effect of myofascial release and scapular stabilization exercises on MPS cases secondary to surgery.

PATIENTS AND METHODS

Patients

A total of 40 patients, from both genders with ages ranging from 25 to 65 years, diagnosed with cervical MPS following ND were referred from Damanhur Oncology center to the Outpatient Clinic of Damanhur Medical National Institute. Two groups of equal number were randomly allocated to participate in this study.

Patients who met the following criteria were eligible to participate in the study: (1) the participants' ages ranged from 25 to 65 years old. (2) Previous unilateral modified radical neck dissection (MRND) at least one month, (3) MPS history at upper trapezius muscle (UTM) at least one month following MRND. (4) Visual analogue scale (VAS) score of >4 indicating moderate to severe pain. (5) All patients enrolled to the study had their informed consent.

Participants were ruled out if they have one of the following conditions: (1) Wound in the area of affection, (2) lesion at cervical disc, (3) spondylolisthesis or fracture at cervical spine, (4) Rheumatoid arthritis, (5) Epilepsy or any psychological disorders.

Design

Patients were divided into 2 groups randomly in this clinical trial, each with an identical number of participants via envelope mode. The study's entire scope was revealed, and informed consent was acquired. Cards with either "MPR and SSE" or "conventional therapy" written on them were wrapped in envelopes once patients agreed to participate in the trial. Physical therapist who was blind to the study protocol was then asked to choose one of the envelopes. Participants were assigned to the appropriate group based on the selected card. Starting dates for treatment was determined, which began after the first week of randomized process. The evaluator physiotherapist was not part of the randomization process and was uninformed of the intervention assignment. During the examination, participants were instructed not to reveal anything to the physiotherapist about their therapeutic assignment. Throughout the treatment period, the subjects were informed to describe any undesirable outcomes.

Assessment methods:

VAS: In the clinical field, VAS is an assessment device that is both valid and reliable aiming to evaluate pain severity. It consists of a continuous scale that consists of a 100 mm horizontal or vertical line with extremes marked as "no pain" and "worst imaginable pain," which is the most often used measure for evaluating pain intensity. Patients are then asked to draw a distinction on that line to show their pain level [16].

Pressure pain threshold assessment: The pressure algometer (Egyptian algometer patent No.258 for 2017. 0-10kg/5g, 10-50g/10g) was used to assess the trigger points' PPT. It has a rubberized disc (whose surface is 1 cm2) with a pressure pole connected to it and put into a gauge to measure kilograms of pressure. Palpation was used for the location of all MTrPs while the patients were in the sitting position. On the first visit, a marker was used to mark the most painful point in the trapezius. An algometer was manually applied perpendicular with slow compression to determine the minimal pressure that causes pain. The average number was calculated from three measurement readings. Individuals were asked to identify once the pressure felt intolerable and painful to relieve the algometer quickly. When patients reported pain, the pressure was stopped [5, 17].

Universal goniometer: The universal standard goniometer was used to determine neck ROM. On both sides, rotation and lateral flexion were evaluated. To eliminate mistakes and compensatory movements, ROM was evaluated at a sitting position. The subjects were instructed to sit with the backrest of the chair supporting their thoracic and lumbar spines. The participant's hips, knees, and ankles had all been placed at a 90-degree angle, with arms having been placed over chest to reduce thoracic mobility. In order to minimize creeping and acclimatize patients to the testing technique, each participant was asked to actively perform cervical motions to their maximum range [18].

Treatment

Both groups received traditional therapy 3 times per week for 8 weeks with duration about 15 minutes. (1) ROM exercise for cervical muscles. (A) Neck lateral flexion ROM: patient was asked to Pull chin back and slowly bend head to the right side to get ear close to shoulder, then hold for 1 count before straightening head again. Then exercise was repeated on the left side. (B) Neck rotation ROM: The patient was instructed to loosen shoulders and rotate head to the right side without feeling pain. To stimulate the neck muscles, the patient kept chin tucked. Then exercise was repeated on the left side. (2) Stretching exercises for cervical muscles: A low-intensity long-duration stretch was applied to the patients. (A) Stretching UTM: The patient sat up straight in the chair, hands gripped at the seat's bottom, and lateral flexion was applied to the patient by gently moving the patient's ear to the shoulder until the opposite side of the neck was comfortably stretched; the position was held for 20 seconds, then repeated three times. (B) Post isometric relaxation (PIR) for UTM: patient was in a supine lying position with the head free from the plinth in a stretched position and held by the therapist's hand. To reduce the possibility of increasing muscle tone, isometric resistance was applied to the tightened muscle and sustained for 7 seconds with mild muscle contractions while inhaling in and holding breath throughout the contraction. The patient was then instructed to exhale and relax for 3 seconds. Static stretching was applied in the other direction for 30 seconds. The technique was repeated three times on both sides. (3) Strengthening exercises for cervical muscles: Manual resistance was established by instructing the participant to move a joint through a movement, but the participant was resisted, preventing any movement. (A) Neck lateral flexion strengthening: The patient was instructed to gradually bend their head to the right side. As the patient tried to move the neck towards right lateral flexion, manual resistance was applied to the patient's right side head with one hand while supporting the patient's right shoulder girdle with the other hand. The same was repeated for neck left lateral flexion. (B) To strengthen the neck rotation, the patient was asked to turn their head as far as they could comfortably see the right shoulder. Manual resistance was applied to the patient's right side head while the other supported the patient's right shoulder girdle. Then the same was repeated for neck left rotation.

The study group additionally received MPR for 20 minutes and SSE for about 30 minutes. Prior to and post-intervention, all measurements were assessed. Every patient in the group (A) was completely informed by the protocol and the benefits of treatment to obtain cooperation and motivation. Instructions were given to the patient to empty bladder and sleep in a prone lying position with the treatment side's upper limb hanging beside body for relaxation of the periscapular muscles. UTM was palpated with the index and thumb fingers of the therapist with the use of a pincer palpation to test for MPS, which was confirmed when the same point was described as uncomfortable and painful at least twice throughout the palpation [19]. With the UTM in a stretched position, the MTrP was gently pressed till the pressure felt became intense and painful. Then the pressure was maintained till the pain was minimized by around 50%. Two more times, the pressure was increased till the onset of pain [20]. MFRT was applied unilaterally on the operated side at low amplitude; long duration to stretch the muscles and fascia for a long time [14].

After that, patients were raised to perform SSE bilaterally on both sides, which included: (1) TYl Exercises: These exercises were performed both standing and prone-lying. Participant was asked to retract scapulae, fully extend elbows and fingers with palms facing inwards, and simply trying to keep those postures throughout the exercise, Aligning head to follow the method by imitating the shapes of T, Y, and I with the arms. First patient applied letter (T) exercise by positioning both shoulders abducted 90^o with both elbows flexed 90^o and scapulae were retracted, then arms were externally rotated with maintaining the 90^{o}abduction of arms with keeping scapulae in retraction. Then patient applied letter (Y) exercise by raising arms over head and extending elbows while flexing and abducting shoulder to 120^o to create the letter Y with keeping scapulae in retraction. Then patient applied letter (I) exercise by raising arms over head and extending elbows while flexing shoulder to create the letter I **[21]**, (2) T to Y to W: patient slept in a prone position and formed the letter T (as described previously), then switched to a letter Y position with thumbs up, raised arms 10-15 cm while retracting and depressing scapula, and finally formed the letter W by flexing elbows and extending shoulders while preserving scapula retracted **[21]**, (3) Scapular Protraction exercise: at which Patient was positioned in a prone lying position with toes and forearms supported the body, then pushed up 1-2 cm and protracted the scapulae **[21]**, (4) Scapular retraction at which Patient tried to squeeze the blades of the shoulder together, bringing them closer to the centerline as if trying to hold a coin . For a total of 5 seconds, this position was held. It was applied ten times **[22]**, scapular retraction also was done plus external rotation of shoulder by instructing the patient to initially keep arms adducted and forearms in midline, then pull away towards the outside of the elbow while transitioning from pronation to supination **[22]**, **(**5) Standard wall push-up exercise: at which the patient inhaled deeply then pressed their body against the wall, as if doing a push-up exercise.

Thereafter, the patient breathed out and returned to the position of the beginning, maintaining elbows near to the sides **[21]**. In between each repetition, a push-off from the wall was added to make the exercise more difficult **[23]**. Standard wall push-up exercises were also applied as plyometrics in a corner with pushing-off and changing hand positions within the repeats **[23]**, also, an elastic band was integrated around the wrists to increase the force on the stabilizers of the scapula **[23]**, (6) Horizontal pull exercise: at which the patient was standing, with both shoulders flexed 90^o and elbows extended as the starting position. The patient then externally rotated shoulders and supinated forearms, pulling away from the midline in an outward motion while attempting to squeeze the shoulder blades together **[24]**, an elastic band was also used at a horizontal pull as part of the exercise to make the exercise more difficult by increasing the force on the stabilizers of the scapula **[25]**, (7) Knee push-ups: with knees comfortably parted and hands slightly wider than shoulder width, the patient slowly lowered chest and flexed elbows until chin was in contact with the ground, then gradually returned to the starting position, focusing on keeping the scapulae pinched together **[22]**, (8) External rotation of shoulders on both sides with resistance offered by elastic bands: the patient was standing, with both shoulders adducted and elbows flexed, and then applied external rotation of both shoulders with resistance provided by elastic bands **[23]**. Throughout this motion, the patient focused on keeping the scapulae pinched together. All SSE were performed in 3 sets of 10 repetitions **[25]**.

Ethical consent:

This study was approved by the Ethical Committee of the Faculty of Physical Therapy, Cairo University (No. P.T.REC30/1/115). Every patient signed an informed written consent for acceptance of participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test ($\chi 2$) and Fisher's exact test to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean and standard deviation (SD). To confirm that the groups were homogeneous, Levene's test for homogeneity of variances was used. To compare the mean values of PPT, VAS and ROM between groups, an unpaired t-test was used. For each group, a paired t-test was used to compare pre and post therapy. For all statistical tests, the significance level was set at $p \leq 0.05$.

RESULTS

Patients' characteristics:

Table 1 showed the patients' characteristics of the intervention and control groups. There was no significant difference between groups in age, time since ND, sex and side of ND distribution ($p>0.05$).

Table (1): Comparison of patients' characteristics between study and control groups:

	Intervention group	Control group		
	Mean ± SD	Mean ± SD	t- value	P-value
Age (years)	39.75 ± 13.78	39.5 ± 12.24	0.06	0.95
Time since ND (months)	3.55 ± 0.75	3.4 ± 1.18	0.47	0.63
Sex, N (%)				
Females	12 (60%)	14 (70%)	(χ^2 = 0.44	0.51
Males	8 (40%)	6 (30%)		
Side of ND, N (%)				
Right	12 (60%)	13 (65%)	χ^2 = 0.11	0.74
Left	8 (40%)	7 (35%)		

SD, Standard deviations; χ^2, Chi squared value; P-value, Probability value.

Effect of treatment on VAS, PPT and ROM:
Within group comparison:

There was a significant decrease in VAS and a significant increase in PPT post treatment compared with that pretreatment in the study and control groups (p <0.001). The percent of change in VAS and PPT in study group was 76.92 and 103.6% respectively and that in control group was 58.06% and 37.76%, respectively (Table 2).

There was a significant increase in bending and rotation toward and away from the operated side post treatment compared with that pretreatment in the study and control groups (p <0.001). The percent of change in bending toward side of operation, bending away from side of operation, rotation toward side of operation, rotation away from side of operation in study group was 45.29%, 45.08%, 26.94% and 25.26%, respectively, and that in control group was 28.42%, 28.52%, 11.61% and 10.75%, respectively (Table 3).

Between group's comparison:

There was no significant difference between groups pre-treatment (p >0.05). Comparison between groups post treatment revealed a significant decrease in VAS of the intervention group compared with that of the control group (p=0.001). There was a significant increase in PPT of the intervention group compared with that of the control group (p=0.002) (Table 2).

There was a significant increase in bending toward and away from the operated side of the intervention group compared with that of the control group post treatment (p=0.001). There was a significant increase in rotation toward and away from the operated side of the intervention group compared with that of the control group post treatment (p=0.001) (Table 3).

Table (2): Mean VAS and PPT pre and post treatment of intervention and control groups:

	Intervention group	Control group			
	Mean ± SD	Mean ± SD	MD	t- value	P- value
VAS					
Pre treatment	7.8 ± 1.15	7.75 ± 1.1	0.05	0.13	0.89
Post treatment	1.8 ± 0.76	3.25 ± 0.9	-1.45	-5.25	0.001
MD	6	4.5			
% of change	76.92	58.06			
t- value	33.76	29.24			
	p = 0.001	***p = 0.00***			
PPT(kg)					
Pre treatment	2.22 ± 1.2	2.41 ± 1.19	-0.19	-0.5	0.61
Post treatment	4.52 ± 1.14	3.32 ± 1.	1.2	3.24	0.002
MD	-2.3	-0.91			
% of change	103.6	37.76			
t- value	-20.65	-17.73			
	p = 0.001	***p = 0.001***			

SD, standard deviation; MD, mean difference; P-value, probability value

Table (3): Mean ROM pre and post treatment of intervention and control groups:

ROM (degrees)	Intervention group	Control group			
	Mean ± SD	Mean ± SD	MD	t- value	P- value
Right bending					
Pre treatment	29.7 ± 7.52	28.5 ± 5.79	1.2	0.56	0.57
Post treatment	43.15 ± 2.56	36.6 ± 3.61	6.55	6.6	0.001
MD	-13.45	-8.1			
% of change	45.29	28.42			
t- value	-9.27	-11.11			
	p = 0.001	***p = 0.001***			
Left bending					
Pre treatment	29.5 ± 4.8	28.75 ± 6.26	0.75	0.42	0.67
Post treatment	42.8 ± 2.33	36.95 ± 3.76	5.85	5.91	0.001
MD	-13.3	-8.2			
% of change	45.08	28.52			
t- value	-13.81	-10.21			
	p = 0.001	***p = 0.001***			
Right rotation					
Pre treatment	67.55 ± 10.61	68.05 ± 8.45	-0.5	-0.16	0.87
Post treatment	85.75 ± 4.43	75.95 ± 5.67	9.8	6.08	0.001
MD	-18.2	-7.9			
% of change	26.94	11.61			
t- value	-11.3	-9.31			
	p = 0.001	***p = 0.001***			
Left rotation					
Pre treatment	68.1 ± 7.38	68.35 ± 8.53	-0.25	-0.09	0.92
Post treatment	85.3 ± 3.24	75.7 ± 5.08	9.6	7.12	0.001
MD	-17.2	-7.35			
% of change	25.26	10.75			
t- value	-10.26	-6.24			
	p = 0.001	***p = 0.001***			

SD, standard deviation; MD, mean difference; P-value, probability value.

DISCUSSION

The aim of the research is to explore the impact of MPR and SSE at MPS following ND surgery in reducing pain and improving cervical ROM. Based on our knowledge, it is the first study that assessed the combined effect of myofascial release and scapular stabilization exercises on MPS cases secondary to surgery.

In this study, the results showed that there were significant improvements in VAS, PPT, bending and rotation toward and away from the operated side post treatment compared with that pretreatment in both groups ($p < 0.001$). The percent of change in VAS and PPT in study group was 76.92% and 103.6% respectively, while in control group was 58.06% and 37.76% respectively. The percent of change in bending toward and away from the side of operation in study and control group was 45.29%, 45.08%, 28.42%, and 28.52% respectively, while rotation toward and away from the side of operation was 26.94%, 25.26%, 11.61% and 10.75%, respectively. However, post treatment, the study revealed higher improvement in all parameters within the study group compared to the other group ($p < 0.01$). These outcomes may be due to the proper alignment of the scapula, as SSE improves the strength and stability of the muscles that surround the scapula with maintaining the correct scapular position and decreasing the pain and symptoms that occur within the muscles [24], hence aids in the recovery of muscle and motor control capabilities and improves an individual’s coordination. Furthermore, MFRT preserves tissue elasticity in tissues like fascia that have undergone surgery through applying low-load, long-duration stretching on the myofascial complex to improve function, reduce pain, and restore optimal length [25].

Several studies have been conducted to assess the MFRT's effects on improving ROM and decreasing pain. **Pawaria and Kalra** [26] applied a comparison to examine which one of MFRT or stretching of muscle has an effect on disability, pain, and ROM in patients with upper trapezius MTrPs. Six sessions in total were applied, three times/week for two weeks, to 32 patients complaining of MPS in UTM using VAS and neck disability index (NDI) assessment. The percentages of VAS score improvement and NDI were 70.41% and 62.38 %, respectively. MFRT produced better benefits in terms of pain relief, and functional status in the participants. Our study differs from theirs in that objective assessment methods were used in ours, unlike in theirs. However, the previous study provides patients’ follow up, which is absent in ours. Notwithstanding, the results of these studies coincided with our results as far as the efficacy of MFRT in pain management and ROM were concerned.

In addition, **Parab *et al.*** [27] compared the effects of MFRT and Muscle Energy Technique on trapezius muscle spasm in 24 patients with neck and head tumors for 6 consecutive days of intervention. Post treatment, the evaluations revealed a mean difference (-1.58 ± 0.51) in PPT, while RT and LT side bending and rotation was -2.25 ± 1.09, -2.83 ± 1.44, -3.00 ± 1.64, and -3.50 ± 1.28 respectively. The results of the previous study support the findings of this study, reflecting significant improvement in pain threshold and cervical ROM, the similarity between past study and this study is using the MFRT and assessment of PPT and cervical ROM.

However, **Parab *et al.*** [27] assessed shoulder ROM, neck disability by NDI, and quality of life (QOL) which are lacked in ours and could provide better statistical analysis, nevertheless, there is a difference between the two aforementioned studies and our study in the outcomes, we supposed that higher improvement in our study is due to two reasons, the first one is the longer duration of treatment which lasted for 2 months (3 times weekly), and the second one is due to adding scapular stabilization exercise to MFRT that played a significant role in strengthening the scapular muscles and correcting the scapular position.

On the other hand, **Sulistyaningsih *et al.*** [28] applied systematic review with the PICO framework (Population, Intervention, Comparison, Outcomes) to the efficacy of MFRT on neck pain and function in MPS at UTM in 3684 articles from 3 databases, and it was concluded that introducing MFRT in cases with MPS including UTM is beneficial for promoting functional mobility and lowering pain in the neck.

Also, **Werenski** [29] applied literature review about the impact of MFRT in the management of MPS through generated articles, emphasizing the way the technique was performed. It was concluded that MPS can be treated extremely efficiently with the use of an adequate myofascial procedure. The outcomes of our study are supported by the results of prior two reviews, and confirming the beneficial effects of MFRT on MPS cases, we supposed that underlying mechanism of MFRT including ROM enhancement through repetitive motion strain, molecular processes, and biological effects on human fibroblasts. The majority of ideas about MFRT's methodology of action have concentrated on the type of fascia. Although mechanical mechanisms were the first to be hypothesized, neurophysiological mechanisms have been proposed for more than 20 years to explain the benefits of manual therapy. Thixtrophy, piezoelectricity, adhesions of fascia and reactions in the cell, fascial inflammation and fluid flow are all mechanical processes of MFRT. Neurophysiological processes involve the Golgi reflex arc, whereas the other involves additional mechanoreceptors. In the Golgi reflex arc theory, Golgi tendon organs (GTOs) send afferent data to the spinal cord when a muscle is stretched. Pressure applied during MFRT is thought to have these effects: GTOs are stimulated, motor unit firing rates are decreased, and muscular tension is reduced. Pacini corpuscles and Ruffini, as well as interstitial muscle receptors, also known as mechanoreceptors, are a type of mechanoreceptor typically found in fascia and represent the other key neurophysiological mechanism. Pressure on mechanoreceptors may activate the neurological system, resulting in a reduction in muscle tension [30].

Some studies approved the effectiveness of SSE in improving ROM and minimizing pain in MPS. **Park *et al.*** [31] compared between stretching exercise, massage, and SSE impact in patients with MPS in UTM. Only 23 female patients complaining of MPS at UTM received sessions 3 times per week for 6 weeks. Assessments included VAS, PPT, and upper stability level. **Park *et al.*** [31] reported significant improvement in all parameters in favor to the SSE group, as the mean differences of pain level, and PPT were 5.23 and -3.31 respectively. Moreover, upper-extremity stability was highest in the SSE group ($p < 0.01$). Also, **Lee *et al.*** [32] compared between the impact of extracorporeal shock wave therapy, SSE, and taping on individuals with MPS of UTM. Both studies are similar as they both apply assessment using VAS for pain assessment and PPT, while **Lee *et al.*** [32] also assess using a constant-murley scale (CMS). SEE was used in this study for three sets of ten reps with three seconds of rest after holding the posture for ten seconds. There was a 3 minute rest period between each set. SSE was applied twice a week for 4 weeks. It was found that the stabilizing group experienced a significant reduction in pain and a significant gain in ROM, ADL, strength, and overall shoulder grade ($p < 0.05$). The mean differences of pain level, and PPT in SSE group were 2.19 and -3.5 respectively in terms of the effectiveness of SSE for pain management, the findings of these trials were consistent with our findings, however, the two aforementioned studies reported higher PPT score than ours, the reason for this is not clear, the possible explanation is introducing hot packs, TENS, and US beside SSE which could assist in pain relief.

Furthermore, **Park *et al.*** [31] conducted a follow-up assessment, which is lacked in ours. The results of the present study are supported by prior studies, indicating that the main rehabilitation program following NDS should focus on strengthening scapular stabilizers muscles for more efficient recruitment of trapezius muscle fibers and more maximizing of activity of trapezius muscle to repair the biomechanics of scapular imbalance that lead to a considerable improvement in pain reduction, improving PPT and increasing ROM.

There were no side effects or adverse effects of the treatment in this study, however, the study was limited by small sample size and absence of shoulder ROM assessment and follow up which could provide better statistical analysis. Variations in skills and experience among oncology surgeons, possible human errors in measurement or therapeutic procedures, and patients` cooperation during the treatment were all factors that could limit this study.

In conclusion, MPR and SSE are two therapeutic approaches for cervical MPS after ND there are both safe and effective. Higher improvement in neck pain and ROM were reported which in turn illustrate the beneficial effect of both MPR and SSE for cervical MPS cases following NDS.

Acknowledgment: We appreciate and thank all of the therapists and PT assistants who helped in patient care and management and data collecting. We'd also like to thank all of the patients who involved at the treatment.

Financial support and sponsorship: Nil.

Conflict of interest: Nil.

REFERENCES

1. **Bakshi J, Panda N, Mohammed A *et al.* (2012):** Neck dissection-Techniques and complications. Clinical Application and Recent Advances, pp. 1-27. Available at; https://www.intechopen.com/chapters/28954.
2. **McGarvey A, Osmotherly P, Hoffman G *et al.* (2013):** Scapular Muscle Exercises Following Neck Dissection Surgery for Head and Neck Cancer. A Comparative Electromyographic Study. Physical Therapy, 93(6):786-797.
3. **Wistermayer P, Anderson K (2021):** Radical Neck Dissection. In StatPearls [Internet]; StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK563186/
4. **Sharp E, Roberts M, Żurada-Zielińska A *et al.* (2021):** The most commonly injured nerves at surgery. A comprehensive review Clinical Anatomy, 34(2):244-262.
5. **Kamel F, Basha M, Alsharidah A *et al.* (2020):** Efficacy of Extracorporeal Shockwave Therapy on Cervical Myofascial Pain Following Neck Dissection Surgery: A Randomized Controlled Trial. Annals of Rehabilitation Medicine, 44(5):393-401.
6. **Chiesa-Estomba C, Soriano-Reixach M, Thomas-Arrizabalaga I *et al.* (2021):** Complications after Functional Neck Dissection in Head and Neck Cancer Patients. An Observational, Retrospective, Single-Centre Study. J Otorhinolaryngol Relat Spec., 83(5):372-380.
7. **Teymoortash A, Hoch S, Eivazi B *et al.* (2010):** Postoperative morbidity after different types of selective neck dissection. The Laryngoscope, 120(5):924-929.
8. **Cristancho M, Subieta G, Torres M (2021):** Myofascial Pain Syndrome and Fibromyalgia in Chronic Pain Management in General and Hospital Practice. Springer, Singapore. pp. 355-371. https://link.springer.com/chapter/10.1007/978-981-15-2933-7_21
9. **Mazza D, Boutin R, Chaudhari A (2021):** Assessment of myofascial trigger points via imaging A systematic review. American Journal of Physical Medicine and Rehabilitation, 100(10):1003-1014.

10. **Ahmed H, Jarrar M, Ahmed R *et al.* (2020):** Effect of Post-Isometric Relaxation and Laser on Upper Trapezius Trigger Point Pain in Patients with Mechanical Neck Pain. Nigerian Journal of Clinical Practice, 23(12):1660-1666.
11. **Nunes A, Moita J, Espanha M *et al.* (2021):** Pressure pain thresholds in office workers with chronic neck pain. A systematic review and meta-analysis. Pain Practice, 21(7):799-814.
12. **Kanaparthi A, Kesary S, Pujita C *et al.* (2020):** Bio Electro Magnetic Energy Regulation (BEMER) therapy in myofascial pain dysfunction syndrome: A preliminary study. Journal of Oral Biology and Craniofacial Research, 10(2):38-42.
13. **Debrosse M, Shergill S, Shah A *et al.* (2022):** Trigger Point Injection Therapies for Chronic Myofascial Neck and Back pain. A Systematic Review. Interventional Pain Medicine, 22:100076.
14. **Dhiman N, Das B, Mohanty C *et al.* (2021):** Myofascial release versus other soft tissue release techniques along superficial back line structures for improving flexibility in asymptomatic adults. A systematic review with meta-analysis. Journal of Bodywork and Movement Therapies, 28:450-457.
15. **Oh J, Park J, Kim S *et al.* (2003):** Comparison of muscle activity during a push-up on a suspension sling and a fixed support. Physical Therapy Korea, 10(3):29-40.
16. **Alghadir A, Iqbal A, Anwer S *et al.* (2020):** Efficacy of combination therapies on neck pain and muscle tenderness in male patients with upper trapezius active myofascial triggers points. BioMed Research International, 20:1-9.
17. **Linde L, Kumbhare D, Joshi M *et al.* (2018):** The relationship between rate of algometer application and pain pressure threshold in the assessment of myofascial trigger point sensitivity. Pain Practice, 18(2):224-229.
18. **Pattanshetty R, Mathias O, Chopde C (2018):** Effect of proprioceptive neuromuscular facilitation neck pattern exercise on cervical range of motion and quality of life in post-operative head and neck cancer patients: An interventional study. Int J Physiother Res., 6(5):2857-2863.
19. **Van Wilgen C, Dijkstra P, van der Laan B *et al.* (2004):** Morbidity of the neck after head and neck cancer therapy, Head Neck, 26:785-791.
20. **Stieven F, Ferreira G, de Araújo F *et al.* (2021):** Immediate Effects of Dry Needling and Myofascial Release on Local and Widespread Pressure Pain Threshold in Individuals with Active Upper Trapezius Trigger Points. A Randomized Clinical Trial. Journal of Manipulative and Physiological Therapeutics, 44(2):95-102.
21. **Moezy A, Sepehrifar S, Solaymani Dodaran M (2014):** The effects of scapular stabilization based exercise therapy on pain, posture, flexibility and shoulder mobility in patients with shoulder impingement syndrome, A controlled randomized clinical trial. Medical Journal of the Islamic Republic of Iran, 28:87-92.
22. **Ganu S, Gor U (2021):** Effects of Abdominal Control Feedback and Scapular Stabilization Exercise on Chronic Neck Pain. International Journal of Health Sciences and Research, 11(6):318-325.
23. **Mcgirr K, Ibsen S, Kennedy T *et al.* (2015):** An elastic exercise band mounted with a Bandcizer™ can differentiate between commonly prescribed home exercises for the shoulder. International Journal of Sports Physical Therapy, 10(3):332-336.
24. **Buttagat V, Taepa N, Suwannived N *et al.* (2016):** Effects of scapular stabilization exercise on pain related parameters in patients with scapulocostal syndrome. A randomized controlled trial. Journal of Bodywork and Movement Therapies, 20(1):115-122.
25. **Jeong S, Lee H (2021):** The Effects of Myofascial Release on Pain Threshold and Sympathetic Hyperactivity in Patients with Adhesive Capsulitis: Case Study. The Journal of Korean Academy of Orthopedic Manual Physical Therapy, 27(2):87-92.
26. **Pawaria S, Kalra S (2015):** Comparing effectiveness of myofascial release and muscle stretching on pain, disability and cervical range of motion in patients with trapezius myofascial trigger points. Indian Journal of Health Sciences and Care, 2(1):8-13.
27. **Parab A, Pattanshetty R (2019):** Effect of myofascial release versus muscle energy technique on trapezius spasm in head and neck cancer patient A randomized clinical trial. Indian Journal of Physical Therapy and Research, 1(2):114-121.
28. **Sulistyaningsih S, Putri A (2020):** Myofascial Release Reduces Pain and Improves Functional Neck Myofascial Pain Syndrome Upper Trapezius Muscle. Journal of Physical Therapy, 5(2):122-131.
29. **Werenski J (2011):** The effectiveness of Myofascial release technique in the treatment of Myofascial pain. Lit Rev., 32:440-450.
30. **Beardsley C, Škarabot J (2015):** Effects of self-myofascial release. A systematic review; Journal of Bodywork and Movement Therapies, 19(4):747-758.
31. **Park Y, Kim S, Oh D *et al.* (2011):** Comparison of the Effects of Massage, Stretching Exercise and Scapular Stabilization Exercise in Patients with Upper Trapezius Myofascial Pain Syndrome. The Journal of Korean Academy of Orthopedic Manual Physical Therapy, 17(1):1-8.
32. **Lee J, Hwang K, Park Y *et al.* (2012):** Comparing the effects of stability exercise, ESWT, and taping for patients with myofascial pain syndrome of upper trapezius. Journal of Korean Physical Therapy, 24(2):82-89.