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EFFECT OF MUSCLE ENERGY TECHNIQUE ON NON-SPECIFIC NECK PAIN IN MILITARY AIR CREW

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ABSTRACT

Background: Nonspecific neck pain has been defined as pain perceived in the cervical region whose origin and precise pathophysiological mechanism(s) is unknown resulting in physical disabilities in military aircrew members. **Objective**: This study was conducted to investigate the effectiveness of Muscle energy technique in nonspecific neck pain in military aircrew members. **Methods**: A total of 60 subjects participated in this study aged from 35 to 45 year divided into two groups underwent 12 sessions. Control group (A), n 30 received conventional physiotherapy (manual therapy and therapeutic exercises) only and Experimental group (B), n 30: received a combination of conventional physiotherapy and Muscle energy technique. They were evaluated before the treatment, and after 4 weeks, using Numeric pain rating scale, Clinometer smart phone application and neck disability index. **Results:** MANOVA revealed that significant decreased in pain intensity, NDI and improvement in cervical range of motion between pre-treatment and post-treatment. **Conclusion**: Adding muscle energy technique to conventional treatment yields significant decreased in pain intensity, neck disability and improvement in cervical ROM for nonspecific neck pain in military aircrew members.

INTRODUCTION

Nonspecific neck pain is defined as pain or discomfort accompanied by or limitation of movement in cervical region of unknown origin **(Hidalgo et al., 2017)**. Stressful and bad biomechanical working posture is one of the major causes of nonspecific neck pain. Specific occupational groups are more likely to suffer from nonspecific neck pain **(lv et al., 2018).** Neck pain prevalence in general population ranges from 22 to 30% **(Yesim et al.,2009)** while global military helicopter community has been reported in the range of 56.6 – 84.5% **(Salmon et al., 2011).**

Pilots sit in an Asymmetric fixed posture for long periods and they may wear a helmet for protection with helmet-mounted displays such as night vision goggles (NVG) **(Thuresson et al., 2005),** moreover aircrew members are subjected to vibrations inside the cabin that causes increase in muscular activity **(Ang et al., 2006).**

Previous Systematic review studies supported the use of conventional physical therapies that involves combinations of manual therapy (neck, thoracic manipulation and neck mobilization) and exercise for the treatment of nonspecific neck pain **(Leaver et al., 2010, Giannoula et al., 2013).**

Muscle energy technique is an advanced manual technique that uses subject's own voluntary contraction which is effective in reduction of pain, stretching tight muscles and fascia, improving musculoskeletal function, and increasing ROM **(Wilson et al., 2003, Ronald et al., 2013).** Previous studies discussing effect of muscle energy technique on nonspecific neck pain showed significant improvement in pain and functional status **(Gupta et al., 2008). (Sharmila, 2014).**

So, the aim of this study was to investigate the effectiveness of Muscle energy technique in neck pain intensity, on neck range of motion and on neck disability level in military air crew.

MATERIALS AND METHODS

Study design and subjects selection

This study designed as a randomized controlled experimental pre-post measurement that conducted at the Outpatient physical therapy Clinic of Air force specialized hospital in Cairo, Egypt from January to July 2020 on male Egyptian air force aircrew members. The sample size was estimated using the G*power 3.0.10 software (Heinrich Heine University Düsseldorf, Düsseldorf, Germany). and revealed that the appropriate sample size for this study was N=30**.** They were randomly assigned into 2 groups: Group A(control); 30 male patients received conventional treatment (manual therapy and exercise) **(Leaver et al., 2010)**, Group B(experimental); 30 patients received conventional treatment in addition to MET. All patients received explanation of the study objectives and procedures. If the patients fit in the study criteria, they asked to sign the written consent form to participate in the study. Also, they informed that the data collected would be submitted for publication.

Inclusion Criteria

- Nonspecific neck pain defined as pain originating in the neck region whose origin and precise pathophysiological mechanism(s) is unknown **(Bogduk N., 2013).**
- The subjects will be further screened to ensure that they met the criteria documented in the study which include the following
- Age from 35 to 45 years old (**Pippig et al., 2000).**
- Working period not less than 5 years.

- Permanent members in Egyptian air forces complaining from neck pain and dysfunction due to non-specific neck pain.

Exclusion criteria

- Previous surgery in the cervical or thoracic spine or diagnosed with serious pathology like infection, inflammatory disorder, osteoporosis **(Nagrale et al., 2010).**
- Any signs or symptoms of medical "red flags" Violent trauma, Constant progressive, non-mechanical pain (no relief with bed rest), Thoracic pain, Past medical history of malignant tumour, Widespread neurology, (Structural deformity, Fever **(European Commission, 2004)**
- Signs or symptoms of upper motor neuron disease, vestibulobasilar insufficiency, amyotrophic lateral sclerosis.
- Fracture of the cervical spine **(Strunk et al., 2008)**
- Diagnosed cases of disc prolapse **(Ylinen et al., 2007)**

Instrumentations and procedures:

Instrumentation

1. **Numeric pain rating scale**:

It is a valid and a reliable scale that was used to measure Pain intensity level in which the patient has to choose a score from 0 to 10 **(Young et al., 2010).**

2. **Clinometer**:

It is a valid and reliable smart phone application that was used to measure cervical spine active range of motion in degrees. **(Guidetti et al., 2017).** The subject was seated in a high-back padded chair, strapped across the shoulders to the chair using an inelastic belt, feet flat on the floor and shoulders at the same level, an Android phone that was mounted on a helmet fastened securely on the patient's head using an internal adjustable head strap fixed within the helmet top of all patients. Measurements were expressed in degrees; head was kept all the time in neutral position with the help of visual representation of a circular spirit device in the same phone application. The patient was asked to perform neck flexion, extension and side bending to the right/left side until possible ROM is obtained and recorded from the application.

3. **The Neck Disability Index** (Arabic version):

It is a valid and reliable self-rated disability questionnaire used for patients with neck pain that contains 10 items related to pain and function was used to measure disability level in cervical region. Patient had to choose from a 0 to 5 scale with low scores being associated with better function and five representing the greatest level of disability. The scores of each section are summated for a composite total score of 50, which are used to determine the level of disability**(Shaheen et al., 2013)**.

Measurements Procedure:

The measurement took place in a quiet room to avoid any distraction, explained the aim of the study and the procedure to each patient. Each patient signed the consent form as his agreement to share in this study before starting the treatment course and were subjected to the measurement of Pain intensity level by Numeric pain rating scale **(Young et al., 2019),**Cervical active range of motion by Clinometer application **(Guidetti et al., 2017)** and Disability level by Neck Disability Index (NDI) Arabic version **(Shaheen et al., 2013)** measurements were taken before start of the treatment and after 4 weeks **(Arif et al., 2020).**

Intervention procedures:

Group A(control):

Patients received Conventional physiotherapy only consisting of Thoracic and Cervical Spine Mobilization (Sitting Upper Thoracic Thrust, Prone Thoracic Extension Thrust, Cervical Postero-Anterior Central Vertebral Mobilization, Cervical Retraction Mobilization, Cervical Rotation Mobilization and Cervical lateral glides) **(Young et al., 2009).** Following the spine mobilization, subjects were instructed to perform exercises focusing on strengthening of the deep neck flexors and scapulothoracic muscles (Lower and middle trapezius, Serratus anterior) **(Abe et al., 2000)** two sets per session, each set consist of 10 repetitions **(Arif et al., 2020).**

Group (B) (Experimental):

Patients in this group received Conventional physiotherapy combined with Muscle energy technique (Post isometric relaxation technique) for Upper trapezius and Levator scapulae muscles for 3 to 5 repetitions using 30% of maximal isometric contraction for 7 to 10 seconds keeping the stretch beyond resistance barrier for 30 to 60 seconds. As these muscles were overactive due to muscle imbalances (upper crossed syndrome), So they were the targeted muscles. Both groups were treated three times a week for 4 consecutive weeks and measurements was taken before start of the treatment and after 4 weeks **(Arif et al., 2020).**

The patient* starting *position

measurement of extension

Measuring of flexion

Measuring of side bending

Statistical Analysis

Data were expressed as mean± SD. Unpaired t-test was used to compare between subjects characteristics of the two groups. MANOVA was performed to compare within and between groups effects for measured variables.Statistical package for the social sciences computer program (version 20 for Windows; SPSS Inc., Chicago, Illinois, USA) was used for data analysis. *P* less than or equal to 0.05 was considered significant.

RESULTS

Data were collected from sixty patients diagnosed as non-specific neck pain, as shown in table (1); the mean age, weight and height of Group (A) were (40.1±3.1) years, (81±5.7) kg, (177±4.6) cm respectively. The mean age, weight and height of Group (B) were (39.7±3.2) years, (81.6±4.8) kg, (177.8±3.7) cm and respectively. There were no significant differences between the mean of age, weight and height of both groups where (p> 0.05).

Table (1): General Characteristics of subjects of both groups

Measurd variables	Group A Mean±S	Group B Mean±SD	t-value	p-value
Age (years)	40.1±3.1	39.7±3.2	0.407	0.686
Weight (kg)	81±5.7	81.6±4.8	-0.417	0.679
Height (cm)	177±4.6	177.8±3.7	-0.645	0.522

Normality test:

Data were screened for normality assumption, homogeneity of variance, and presence of extreme scores. Shapiro-Wilk and Kolmogrovsmirnov tests for normality showed that all measured variables are normally distributed.

The Effect of treatment on measured variables:

As shown in table (2), MANOVA was conducted to investigate the effect of treatment on measured variables. There was significant interaction effect of treatment and time, there was significant effect of treatment and there was significant effect of time (P = 0.001).

Table (2) MANOVA of the effect of treatment on measured variables

MANOVA	
Interaction effect (Time * treatment)	
F = 23.7	**P = 0.001***
Effect of treatment (group effect)	
F = 25.4	**P = 0.001***
Effect of time	
F = 384	**P = 0.001***

***: significant**

I- Effect of treatment on pain:

Group A:

The mean ± SD of pain pre-treatment of the group A was 7.4 ± 1.27 and post treatment was 5.8 ± 0.62 degree. The mean difference was 1.6 and the percent of change was 21.6%. There was a significant decrease in mean value of pain in group A post treatment compared with that pre-treatment (p = 0.001). (table 3, figure).

Group B:

The mean ± SD of pain pre-treatment of the group B was 7.5 ± 1.22 and post treatment was 3.7 ± 0.6 degree. The mean difference was 3.8 and the percent of change was 50.7%. There was a significant decrease in mean value of pain in group B post treatment compared with that pre-treatment (p = 0.001) (table 3, figure).

Comparison between groups

There was no significant difference in the mean values of pain pre-treatment between both groups (p = 0.695), while there was significant difference post treatment between both groups in favor to group B (p = 0.001) (table 3).

Table 3. ***Mean value of pain pre and post treatment of both groups.***

Pain	**Pre** $\bar{X}$ **±SD**	**Post** $\bar{X}$ **±SD**	**MD**	**% of change**	**P-value**	**Sig**
Group A	**7.4 ± 1.27**	**5.8 ± 0.62**	**1.6**	**21.6%**	**0.001**	**S**
Group B	**7.5 ± 1.22**	**3.7 ± 0.6**	**3.8**	**50.7%**	**0.001**	**S**
f-value	**0.154**	**74.5**				
P-value	**0.695**	**0.001**				
Sig	**NS**	**S**				

$\bar{X}$ **: Mean** **SD: Standard deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

II- Effect of treatment on neck flexion:

Group A:

The mean ± SD of neck flexion pre-treatment of the group A was 43.5 ± 1.7 and post treatment was 48.3 ± 1.62 degree. The mean difference was -4.8 and the percent of change was 11%. There was a significant increase in mean value of neck flexion in group A post treatment compared with that pre treatment (p = 0.001). (table 4, figure).

Group B:

The mean ± SD of neck flexion pre-treatment of the group B was 44.1 ± 1.5 and post treatment was 51.7 ± 1.68 degree. The mean difference was -7.6 and the percent of change was 17.2%. There was a significant increase in mean value of neck flexion in group B post treatment compared with that pre treatment (p = 0.001) (table 4, figure).

Comparison between groups

There was no significant difference in the mean values of neck flexion pre treatment between both groups (p = 0.139), while there was significant difference post treatment between both groups (p = 0.001) (table 4).

Table 4. ***Mean value of neck flexion pre and post treatment of both groups.***

Neck flexion	Pre $\bar{X}$ ±SD	Post $\bar{X}$ ±SD	MD	% of change	P-value	Sig
Group A	43.5 ± 1.7	48.3 ± 1.62	-4.8	11%	0.001	S
Group B	44.1 ± 1.5	51.7 ± 1.68	-7.6	17.2%	0.001	S
f-value	2.21	65				
P-value	0.139	0.001				
Sig	NS	S				

$\bar{X}$: Mean SD: Standard deviation MD: Mean difference
p value: Probability value S: Significant NS: Non significant

III- Effect of treatment on neck extension:

Group A:

The mean ± SD of neck extension pre-treatment of the group A was 53.9 ± 1.6 and post treatment was 61 ± 1.68 degree. The mean difference was -7.1 and the percent of change was 13.1%. There was a significant increase in mean value of neck extension in group A post treatment compared with that pre-treatment (p = 0.001). (table 5, figure).

Group B:

The mean ± SD of neck extension pre-treatment of the group B was 53.3 ± 1.8 and post treatment was 65.4 ± 2.3 degree. The mean difference was -12.1 and the percent of change was 22.6%. There was a significant increase in mean value of neck extension in group B post treatment compared with that pre-treatment (p = 0.001) (table 5, figure).

Comparison between groups

There was no significant difference in the mean values of neck extension pre-treatment between both groups (p = 0.174), while there was significant difference post treatment between both groups in favor to group B (p = 0.001) (table 5).

Table 5. ***Mean value of neck extension pre and post treatment of both groups.***

Neck extension	Pre	Post	MD	% of change	P-value	Sig
	$\bar{X}$ ±SD	$\bar{X}$ ±SD				
Group A	53.9 ± 1.6	61 ± 1.68	-7.1	13.1%	0.001	S
Group B	53.3 ± 1.8	65.4 ± 2.3	-12.1	22.6%	0.001	S
f-value	1.87	84				
P-value	0.174	0.001				
Sig	NS	S				

$\bar{X}$: Mean **SD: Standard deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

IV- Effect of treatment on neck side bending to the right:

Group A: The mean ± SD of neck side bending to the right pre-treatment of the group A was 33 ± 1.9 and post treatment was 39.6 ± 1.5 degree. The mean difference was -6.6 and the percent of change was 20%. There was a significant increase in mean value of neck side bending to the right in group A post treatment compared with that pre-treatment (p = 0.001). (table 6, figure).

Group B: The mean ± SD of neck side bending to the right pre-treatment of the group B was 33.1 ± 2.1 and post treatment was 42.5 ± 1.7 degree. The mean difference was -9.4 and the percent of change was 28.4%. There was a significant increase in mean value of neck side bending to the right in group B post treatment compared with that pre-treatment (p = 0.001) (table 6, figure).

Comparison between groups

There was no significant difference in the mean values of neck side bending to the right pre-treatment between both groups (p = 0.944), while there was significant difference post treatment between both groups in favor to group B (p = 0.001) (table 6).

Table 6. ***Mean value of neck side bending to the right pre and post treatment of both groups.***

Neck side bending to the right	Pre	Post	MD	% of change	P-value	Sig
	$\bar{X}$ ±SD	$\bar{X}$ ±SD				
Group A	33 ± 1.9	39.6 ± 1.5	-6.6	20%	0.001	S
Group B	33.1 ± 2.1	42.5 ± 1.7	-9.4	28.4%	0.001	S
f-value	0.005	38.3				
P-value	0.944	0.001				
Sig	NS	S				

$\bar{X}$: Mean **SD: Standard deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

V- Effect of treatment on neck side bending to the left:

Group A: The mean ± SD of neck side bending to the left pre-treatment of the group A was 32.9 ± 1.5 and post treatment was 40.4 ± 1.3 degree. The mean difference was -7.5 and the percent of change was 22.8%. There was a significant increase in mean value of neck side bending to the left in group A post treatment compared with that pre-treatment (p = 0.001) (table 7, figure).

Group B: The mean ± SD of neck side bending to the left pre-treatment of the group B was 33.1 ± 1.7 and post treatment was 42.4 ± 1.4 degree. The mean difference was -9.3 and the percent of change was 28%. There was a significant increase in mean value of neck side bending to the left in group B post treatment compared with that pre-treatment (p = 0.001) (table 7, figure).

Comparison between groups

There was no significant difference in the mean values of neck side bending to the left pre-treatment between both groups (p = 0.549), while there was significant difference post treatment between both groups in favor to group B (p = 0.001) (table 7).

Table 7. ***Mean value of neck side bending to the left pre and post treatment of both groups.***

Neck side bending to the left	Pre	Post	MD	% of change	P-value	Sig
	$\bar{X}$ ±SD	$\bar{X}$ ±SD				
Group A	32.9 ± 1.5	40.4 ± 1.3	-7.5	22.8%	0.001	S
Group B	33.1 ± 1.7	42.4 ± 1.4	-9.3	28%	0.001	S
f-value	0.361	25.6				
P-value	0.549	0.001				
Sig	NS	S				

$\bar{X}$: Mean **SD: Standard deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

DISCUSSION

Nonspecific neck pain is one of the conditions which can be treated by a wide variety of physiotherapy methods. There has been strong evidence suggests that the targeted subjects who meet the diagnostic classification for non-specific neck pain benefit from a conventional physical therapy that involves combinations of manual therapy (neck, thoracic manipulation and neck mobilization) and exercise. **(Hidalgo et al., 2017).**

Neck pain prevalence among military aircrew members is considered high in this occupational group compared to the general population **(lv et al., 2018).** Non-specific neck pain is mainly caused by mechanical factors such as sprain and strains in general population and also caused by being subjected to excessive G force, multidirectional vibrations, wearing protective helmet with mounted NVG and bad ergonomical posture. Excessive physical strain may cause microtrauma in connective tissues and physiological stress may lead to increased muscular tension**. (Binder, 2007, Rodriquez, et al., 2008).**

Non-specific neck pain is usually accompanied by upper crossed syndrome, where there occurs tightness of suboccipital muscles, Levator scapulae, upper trapezius, sternocleidomastoid, Pectoralis major and minor and weakness of Deep neck flexors, Lower and middle trapezius. (**Chaitow et al., 2003).**

Muscle energy technique which is a voluntary contraction of a subject's muscle(s) in a precisely controlled direction, against the therapist's counterforce which is effective in stretching tight muscles and fascia, strengthening weak muscles, improving musculoskeletal function, mobilizing joints in which movement is restricted and increases ROM and reduction of pain **(Wilson et al., 2003, Ronald et al., 2013).**

MET can be included in physiotherapy treatment plans in addition to conventional physical therapy for military air crew members suffering from non-specific neck pain to improve range of motion, reduce pain and improve function. Post isometric relaxation produces reflex muscle relaxation following contraction through activation of the Golgi tendon organs and their inhibitory influence on the a-motor neuron pool. **(Chaitow, 2006)**

Thus, optimizing treatment strategies for an effective management of nonspecific neck pain in military aircrew members are needed. In this respect, a more conclusive knowledge on the impact of MET on the outcome and adherence to conventional physical therapy interventions in nonspecific neck pain patients is desirable. So the aim of this study was to investigate the effectiveness of MET combined with conventional physical therapy treatment on neck pain intensity level, neck range of motion and neck disability level in patients with non-specific neck pain in military air crew .

In this study sixty male patients were assigned randomly into two equal groups, control group and study group. Thirty patients in control group (A) received conventional treatment (manual therapy and therapeutic exercises), the other thirty patients in experimental group (B) received the same program in group A plus MET. Treatment was applied 3 sessions/week for 4 consecutive weeks for total of 12 sessions and measures (NPRS, ROM and NDI) were taken at baseline, post intervention.

The results of the current study revealed that there was no significant difference between both groups, for post treatment there was a significant improvement in study group (B) than control group (A) as *P value* was *P* less than or equal to 0.05 and there was a significant decreased in pain intensity, NDI and improvement in cervical range of motion between pre-treatment and post-treatment. So both control and study group improved among pain, neck disability and ROM in the short-term (post intervention). However, addition of MET to conventional program of manual therapy and therapeutic exercises in the experimental group showed a significant effect in treating Non specfic neck pain in military air crew.

The results of the current study were agreed by a previous study that reviewed the literature published on interventions for nonspecific neck pain and concluded that there is a strong evidence of efficacy for multimodal conventional care (manipulation/mobilization and supervised exercises. **(Giannoula et al., 2013)**

Furthermore, these improvement may be justified by application of treatment protocol that combined several mobilization techniques and specific therapeutic exercises **(Leaver et al., 2010)**, which may be attributed to concepts speculated that mobilization of a spinal segment stimulates receptors present in joints, capsules, tendons and connective tissues, in addition to direct stimulation of the middle and inferior cervical ganglia, which are adjacent to C6 and C7 respectively, which are capable of directly or indirectly activating descending periaqueductal grey (PAG) mechanisms and make sympathetic response resulting in hypoalgesia and improvement in neck function and ROM. **(Lascurain et al., 2016)**

However, adding MET to the conventional program in the study group showed greater improvement among pain intensity level neck, ROM and dysfunction rather than conventional treatment alone which was supported by recent study stated that combination of MET with Deep neck flexors exercise was more effective than Deep neck flexors exercise alone in improving pain, decreasing disability and correcting forward head posture. **(Narang et al., 2014)**

The findings of this study was agreed also with a study done by **(Arif et al., 2020)** that assessed the effectiveness of Conventional Physical Therapy with and without Muscle Energy Techniques (MET) for the treatment of Upper Cross Syndrome concluded that both conventional therapy and MET are beneficial for the treatment of upper cross syndrome, however MET was superior to conventional physical therapy in alleviating neck pain and disability that is in line with our results.

Gupta et al, 2008 and Sharma et al, 2010 studied the effects of integrated neuromuscular inhibition techniques and post isometric relaxation (MET) with isometric exercises, respectively. They concluded that pain and functional status improved more in the group receiving post isometric relaxation, similar to our study. In addition, a study by

Sharmila et al.,2014). compared the effects of MET with conventional physical therapy for non-specific neck pain and concluded that the MET was an effective regime in alleviating pain and improving disability.

The results of the present study were in current with also a study conducted by **Mahajan et al., 2012)** which favoured the use of MET for mechanical neck pain and showed that MET had marked reduction in neck pain and improvement in neck functions.

The results of this study were disagreed with a study done by **Shenouda, 2012** that comparing MET and stretching concluded that no strategy was superior to the other. Moreover, the effects received as a result of MET cannot be considered purely due to MET only as the effects of conventional physical therapy cannot be ignored. Conventional therapy including application of hot pack, stretching, mobilization and strengthening (are often subjected to imbalance and hence need precise consideration **(Knight et al., 2001).**

This approach can improve clinical outcomes, which may reduce the time of sick leave, improve the rate of patients returning to work and/or former activity and decrease the number of patients who will develop complications. Further research is needed to formulate preventive strategies.

limitations

The sample size was small so it should be done on larger scale with large sample size and use more assessment devices that is valid and reliable rather than clinometer. The study was done in a single place and cannot make generalization of the findings so that it should be applied to a large population of diverse culture and environmental conditions. Also, there was a lack of a strictly recorded, dose-specific home exercise program maintained during the course of treatment.

CONCLUSIONS

This study concluded that application a multimodal conventional program of manual therapy and specific therapeutic exercises integrated with MET in military aircrew members with Nonspecific neck pain yields significant improvement among pain intensity, neck disability and ROM (post intervention) and had greater influence on all variables rather than conventional physical therapy treatment alone.

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Disclosure statement

The authors declare no conflict of interest.

Conflict of interest:

There was no conflict of interest.

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تأثير تقنية تقنية طاقة العضلات علي آلام الرقبة غير النوعية في الأطقم الطائرة العسكرية

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الخلفية: تعرف آلام الرقبة غير النوعية بالألام الذي يتم ادراكها في المنطقة العنقية التي لا يعرف مصدرها والالية الفسيولوجية المرضية لها مما يؤدي إلى إعاقات جسدية لدى أفراد طاقم الطائرة العسكريين.

الهدف: لمعرفة فعالية إضافة تقنية طاقة العضلات إلى العلاج التقليدي للألم والإعاقات الجسدية في آلام الرقبة غير المحددة لدى أفراد الطاقم الجوي العسكري.

الطريقة: شارك في هذه الدراسة 60 شخصًا تتراوح أعمارهم بين 35 و 45 عامًا و خضعوا لـ 12 جلسة وقد تم تقسيمهن الى مجموعتين (أ،ب) متساويتين في العدد، (المجموعة الضابطة (أ) 30شخصا) تلقت العلاج الطبيعي التقليدي (العلاج اليدوي والتمارين العلاجية) فقط و (المجموعة التجريبية (ب)30 شخصا) التي تلقت مزيجًا من العلاج الطبيعي التقليدي وتقنية طاقة العضلات. تم تقييم المرضي قبل العلاج وبعد 4 أسابيع باستخدام مقياس تصنيف الألم

الرقمي (NPRS) وتطبيق الهاتف الذكي Clinometer ومؤشر العجز في الرقبة (NDI).
النتائج: أظهر MANOVA لتأثير العلاج على NPRS و ROM العنق و NDI داخل وبين المجموعات تحسنًا ملحوظًا بين ما قبل العلاج وبعد العلاج.
الخلاصة: يؤدي البرنامج التقليدي للعلاج اليدوي والتمارين العلاجية المدمجة مع MET إلى تحسن كبير في شدة الألم وإعاقة الرقبة و مدي الحركة في حالات آلام الرقبة غير المحدد في أفراد الطاقم العسكري.

الكلمات الدالة: آلام الرقبة غير النوعية – تقنية طاقة العضلات – مؤشر العجز في الرقبة.