# Scientific studies which produced by education members faculty and assistant staff during attending scientific conferences abroad

# 2015-2017

## Scientific Conferences 2017

### Effect of Low Level Laser on Induced Pulmonary Hypertension in Rats

**Hady Atef Labib Mohamed, Z. Helmy, and M. Fadel.**

ESC Congress, European, UK, 2017.

**Type of Participation:** Abstract and search study.

**Abstract**

Background: After the success of the first trials of this experiment which were done on rabbits ,A new study were conducted on dogs to ensure the past results ;in a step forward to use low level LASER(LLL) therapy in the treatment of congenital septal defects in infants.

Purpose The aim of this study was to investigate the effect of LLL irradiation on congenital septal defects in experimental dog model and explain the mechanisms and consequences of the heart exposure to LLL irradiation.

Subjects and Methodology: six male dogs who have congenital septal defects in their hearts - with age ranged 6-10 months- enrolled in this study for one and half months. They were assigned into two groups: Group (A): The study group consisted of 3 canine hearts who received routine animal care associated with LLL irradiation. Group (B): The control group consisted of 3 canine hearts who received only routine animal care. Sizes of the septal defects were measured by echocardiogram for both groups at the beginning and after the end of the study.

Results: Dogs exposed to LLL irradiation showed increase in their body weight and level of activity with increase of the cardiac output of the right ventricle in echocardiogram 3 months after the irradiation. Histological analysis demonstrated an increase in angiogenesis and augmented cell recruitment in the irradiated sites. This cell recruitment was caused by increased activation of circulating fibroblasts, and vascular endothelial cells. However, LLL exposure did not increase any circulating leucocytes or macrophages, proving that there is no any inflammatory process. Consistently, levels of erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were within normal values after 3 months of LLL exposure. In addition, there was significant decrease of size of the diameter of the congenital septal defect with this group by 42.19%. Accordingly, in vivo depletion of leucocytes and macrophages with the abundance of fibroblasts and endothelial cells indicating that the latter group of cells are the prime cause of the shunt healing.

**Abstract**

**Background and purpose:** After the success of the first trials of this experiment which were done on rabbits ,A new study were conducted on dogs to ensure the past results ;in a step forward to use low level LASER(LLL) therapy in the treatment of congenital septal defects in infants. **Subjects and Methodology:** six dogs who underwent induction for ventricular septal defects by cardiac puncture technique with age ranged 6-10 months enrolled in this study for one and half months. They were assigned into two groups: **Group (A):** The study group consisted of 3 dogs who received routine animal care associated with LASER irradiation. **Group (B):** The control group consisted of 3 dogs who received only routine animal care. Size of the septal defects were measured for both groups at the beginning and after the end of the study. **Results:** There was significant decrease of size of the diameter of the induced ventricular septal defect with study group (percentage of improvement was 42.19%) when compared with control group. **Conclusion:** It was concluded that low level LASER therapy can be considered as a promising therapy for congenital heart defects in animals and to be examined on children with similar congenital lesions after then.

**Key words:** LASER, VSD, dogs.

## 1. Introduction

Left-to-right shunt lesions are among the most common CHD lesions that the anesthesiologist will encounter. The level of shunting can occur at any location between intracardiac chambers (i.e., ventricular septal defect [VSD] or atrial septal defect [ASD]), or extracardiac structures (i.e. patent ductus arteriosus [PDA]). The pathophysiologic consequences of L-R shunt depend on several factors: the size of the defect, pressure gradient between chambers or arteries, the pulmonary/systemic vascular resistance (PVR/SVR) ratio, the relative compliance of right and left ventricles, and blood viscosity[1]

Ventricular septal defect (VSD) is the most common congenital heart defect seen in children. Defects can occur at various locations in the septum but most commonly occur in the membranous or muscular portions. Small defects often close spontaneously during childhood. One type of defect, the outflow (or supracristal) VSD, can be spontaneously occluded by one of the aortic leaflets prolapsing into it. This can result in the development of significant aortic insufficiency.[2]

Small VSDs are usually asymptomatic, whereas larger defects are more likely to manifest during childhood with heart failure. VSD is the most common cause of Eisenmenger's syndrome.[2]

Eisenmenger syndrome refers to any untreated congenital cardiac defect with intracardiac communication that leads to pulmonary hypertension, reversal of flow, and cyanosis [3]-[4]-[5]

Surgical closure of the ventricular septal defect is the most commonly performed procedure in pediatric cardiac surgery [6]Postoperative Complications may include heart block and junctional ectopic tachycardia (in infants). Residual VSD's may also remain.[6]

LLLT uses low-powered laser light in the range of 1-1000 mW, at wavelengths from 632-1064 nm, to stimulate a biological response. These lasers emit no heat, sound, or vibration. Instead of generating a thermal effect, LLLT acts by inducing a photochemical reaction in the cell, a process referred to as biostimulation or photobiomodulation.[7](See NOTE 2)

**Purpose of the study:**

Was to investigate whether low level Laser had any effect on the healing of moderate sized induced ventricular septal defects, to investigate whether low level Laser had any side effects on the patient, and to investigate whether treatment with low level Laser could be an adjunctive method of treatment for the traditional surgical choices.

According to our knowledge, there is no past studies conducted in this field but other studies were conducted on the thermal effect of argon laser in palliation of obstructive congenital lesions such as aortic stenosis and coartication of the aorta and it was found to be effective.

This study is considered **A NOVEL TRIAL** to conduct that method of treatment for induced ventricular septal defects. (See NOTE 1)

## 2. Materials

### 2.1. Animals:

Six dogs (See NOTE 11) who underwent surgical induction of moderate sized septal defects in their hearts via cardiac puncture technique were included in the study, aged from 6-10 months and recruited from the Department of physiology at the faculty of veterinary medicine, Cairo University. All subjects of the study were hospitalized and housed in a conditioned environment (22±1°C, 55±5% relative humidity, 12 h light/dark cycles) and were fed standard laboratory chow and water. This investigation conforms to the *Guide for the Care and Use of Laboratory Animals* published by the US National Institutes of Health (NIH Publication No. 85-23, revised in 1996).

They were randomly assigned into two groups:

**The study group:**

The study group consisted of 3 dogs, which received low level LASER therapy at the site of the induced shunt percutaneusly plus routine animal care (feeding, and psychological support).

**The control group:**

The control group consisted of 3 dogs, which received the same induction of the shunt and routine animal care only (feeding, and psychological support).

**Inclusion criteria:**

1-Dogs who underwent surgical induction of moderate sized septal defects in their hearts.

2-Their age ranged from 6-10 months old.

3- Dogs with clinically and medically stable conditions.

**Exclusion criteria:**

Dogs that are apparently not healthy or known to have any kind of illness

**2.2. Instrumentations:**

1. Induction equipment:

Surgical needle: its size is 24 guage used in the induction of the lesion within the heart whilst the heart is exposed.

2. Anesthesia protocol:

General anesthesia with ketamine hydrochloride and xylazine 0.1mg/kg[8]

**2.3. Evaluating equipment:**

Echocardiography:

(PHOX PLUS C 402103020, America)

**2.4. Therapeutic equipment:**

The LASER device:

(laserklasse2M, EN60825-1,+A2:2002,w.l=635-670nm,p<6mW, German)

**3. Methods:**

Demographic data, clinical characteristics and all medical history were collected from dogs' file.

**3.1 Induction procedure (induction of septal defects):** has been done for all rabbits as follows:

1. for each dog before the study, the induction of the ventricular septal defects via opening of the chest via lateral thoracotomy incision.

2. Whilst the heart is exposed a needle is inserted directly into the heart with a cardiac puncture technique to induce moderate sized induced septal defects

3. The induced septal defect was defined as moderate sized when we measured the annulus of the aortic valve by the echocardiography and divided

by 2, the diameter of the annulus of the aortic valve was 1.2+/-0.2cm, so the diameter of the induced shunt was 0.6+/-0.1cm in the hearts of the dogs. (See NOTE 3,5)

4. The shunt is left for 2 weeks before the start of the treatment phase to make sure that it will not heal spontaneously as dogs have much higher healing characteristics than humans. (See NOTE 4)

**3.2 Evaluation procedure:**

Echocardiography: has been done for all dogs as follows:

For each dog before, during, and after the study, the echocardiography was used

1. Before the study, to investigate the exact site of the shunt to apply the laser therapy on it. (See NOTE 6) (Fig.1)
2. During the study, to measure the shunt size before the start of the treatment period to make sure that the shunt did not heal spontaneously
3. After the study, to investigate the differences happened to the shunt after the application of the laser therapy at the end of the study. (Fig.2)

**3.3 Treatment procedure**

Each dog in the study group received laser therapy at the site of the shunt percutaneusly for 15 minutes with two sessions daily for four consecutive weeks.

Laser therapy was introduced to the rabbits as follows:

1. Shaving of the dog hair (See NOTE 7)
2. Adjustment was done for the wave length and intensity of the device.( wave length=635-670nm,p<6mW, 0.5 j/cm2,15minutes) (See NOTE 8,9,10)
3. The dogs had received anesthesia (ketamine hydrochloride and Xylazine 0.1/kg) to decrease their movements during laser application.
4. The dog lied comfortably while holding the laser probe tightly at the site of the shunt which was seen under echocardiography (echo guided) and a marker was put on that site to apply laser at the same point in the first session.
5. The dogs vital signs was closely monitored as the vet was taking the heart rate, respiratory rate and body temperature of the dog at regular intervals every session during the application of the laser.

## 4. Notes:

1. This study aimed to find an alternative or even adjunctive non-surgical method for some congenital heart defects like septal defects whether it is ventricular or atrial, in order to avoid or decrease -at least- open heart surgeries complications, which is still till now the only method for treatment of such cases.
2. The present study revealed that post induction of induced septal defect, a treatment of LASER, has a beneficial effect in increasing of the healing process of the cardiac structures and that came in support with the work of **Mitsos and his colleagues, (2014)** who reported that the application of LASER had been shown to be effective in increasing the revascularization after induced myocardial infarction in rabbits.[9]
3. The size of the shunt is Based on the maximum measured diameter of the defect as compared to a normal aortic valve annulus as follow: Small VSD: < 1/3 of the diameter of the aortic valve annulus, moderate sized VSD: about ½ of the diameter of the aortic valve (which is the only included shunt in the study), and Large VSD: near the same diameter of the aortic valve annulus.[10]
4. The size of the induced shunt was measured via echocardiography after 2 weeks from the induction to give a time for the shunt to heal if it can be healed spontaneously, if you left the shunt for shorter period and started treatment very soon that may be a false indicator about the healing susceptibility of the shunt.
5. The induced septal defect was defined as moderate sized when we measured the annulus of the aortic valve by the echocardiography and divided by 2, the diameter of the annulus of the aortic valve was 1.2+/-0.2cm, so the diameter of the induced shunt was included in the study only if it falls in the range 0.6+/-0.1cm and excluded if less(because that means that it may be a small sized shunt which can heal spontaneously) or more (because that means that it may be large sized shunt which mostly cannot be healed with this procedure).
6. Echocardiography will be applied on the dog after the induction to localize the exact site of the induced shunt, and we put a marker on the skin to know the exact site of laser application, because it was not available for us to use

echocardiography every session, if it is will be applicable for us that would much easier to determine the site where you will apply the laser every session.

7. Before laser application, you have to shave the hair of the dog in –at least- the area where you will apply laser to avoid beam absorption by the hair and therefore decrease of the delivered dose to the site of the shunt.
8. We tried many wave lengths, intensities, and treatment durations during the experiment but finally it was found that high intensities and long wave lengths hinder the healing process, so the optimal dose is 15 minutes of application (with wave length=635-670nm, p<6mW, and energy 0.5 j/cm2), pulsed wave not continuous as the latter induce vasospasm which lead to vascular damage.
9. Avoid using thermal lasers like acute continuous argon-laser because it has ablation and destructive effects rather than healing effects.
10. This class of laser is called class 2M which is very safe for the eye so wearing goggles during application is not needed.
11. It is recommended to study to conduct that research on larger samples.

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## Figures

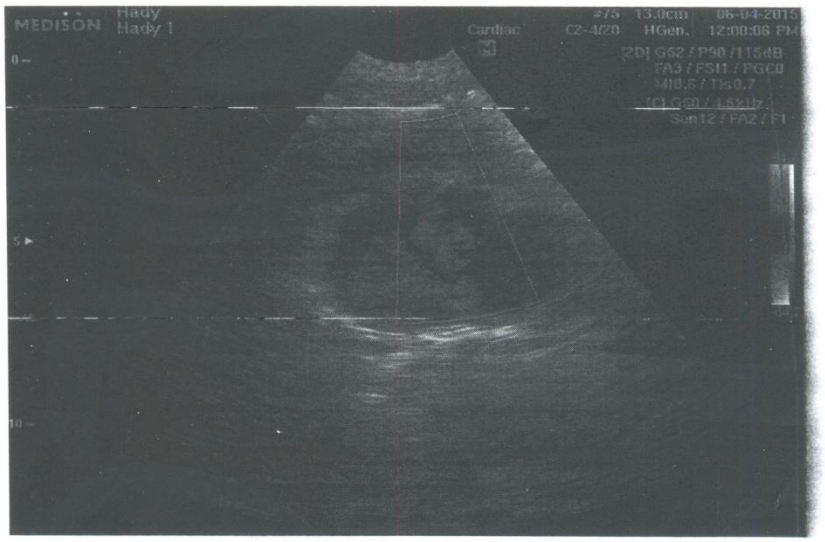


**Fig. (1) : Echocardiography showing the mosaic appearance that happened after induction of the shunt at the beginning of the study**

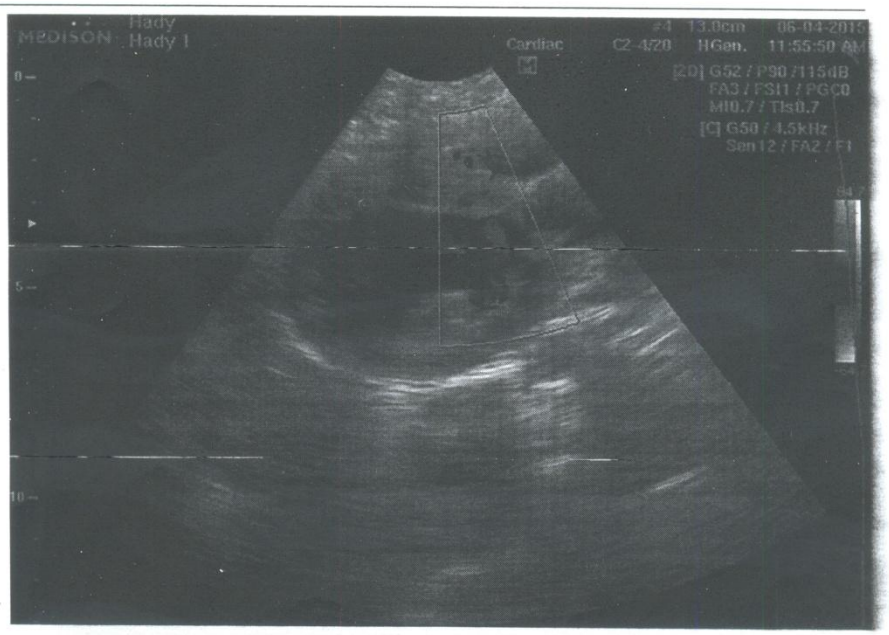


**Fig. (2): Echocardiography showing marked improvement and decrease in the amount of the mixed blood after laser therapy for the shunt (at the end of the study)**

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# Lidocaine Iontophoresis for Intercostobrachial Neuralgia Post Mastectomy

**Nancy Hassan Abo El Yazed Abo Al Nour**

The Australian Physiotherapy Conference, MOMENTUM 2017.

**Type of Participation:** Abstract.

## Abstract

**Aim: To investigate efficacy of lidocaineiontophoresis for neuropathic pain management in intercostobrachial neuralgia post mastectomy.**

**Design: Single blinded randomized controlled trial.**

**Method: Forty patients with partial or radical mastectomywere randomly divided into two equal groups, Group A (lidocaineiontophoresis), Group B (lidocaine patch). The methods of assessment included visual analogue scale and painDETECT questionnaire. Group A received lidocaineiontophoresis day after day for four weeks (10 ml of 2% lidocaine with 0.9 sodium chloride), the application was1 mA electrical current to the cathode for 10 minutes. Group B received lidocaine 5% patch (LIDODERM®) onto the painful area for 12 h daily. Treatment program extended for one month, while evaluation was done pre and post treatment.**

**Results: There was no significant difference between both groups in visual analogue scale (p= 0.14) and pain Detect questionnaire (= 0.32) pre-treatment. Comparison between groups post treatment revealed a significant decrease in visual analogue scale and pain Detect of group A compared with that of group B (p = 0.0001). The percent of decrease in visual analogue scale of group A and B was 86.47% and 61.11% respectively while the percent of decrease in pain Detect was 76% and 49.57% respectively.**

**Conclusion/ Key Practice Points:**
**It was concluded that lidocaineiontophoresis was safe and effective method for intercostobrachial neuralgia management post mastectomy in expression of decreasing pain intensity and quality.**

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# Effectiveness of selected exercises program on Sports hernia: Randomized Control Trial

**Walid Ahmed Ibrahim**

The Australian Physiotherapy Conference, MOMENTUM 2017.
**Type of Participation:** Abstract.

**Abstract**

**Aim:** To determine whether selected exercises program that involves attempts at repetitive, effortful muscle contractions and including core stability, balancing exercises, progressive resistance exercise, and running activity after sport hernia is effective or harmful, and is it worthwhile?

**Design:** Single blinded randomized controlled trial.

**Method**:forty soccer players with sports hernia were randomly divided into two equal groups, Group A (selected exercises program), Group B (conventional treatment). The methods of assessment included visual analogue scale and hip internal and external range of motion assessment. For Group A they received conventional treatment (Heat, Massage, Transcutaneous Electrical Nerve Stimulation and Mobilization) plus selected exercises program while Group B received only conventional treatment, Treatment program extended for two months, three sessions per week, where evaluation was done pretreatment and after the end of the treatment.

**Results:** Comparison between both groups post treatment revealed a significant decrease visual analogue scale of group A compared with that of group B ($p = 0.0001$), The percent of decrease in visual analogue scale of group A and B were 80.25% and 41.93% respectively, while there was no significant difference in internal and external rotation between both groups post treatment ($p > 0.05$).There was a significant improvement in outcome measures of group A compared with that of group B post treatment ($p = 0.01$) as 13 patients in group A and only three patients in group B returned to the sport activity without groin pain.

**Conclusion/ Key Practice Points**:
It was concluded that active exercises were effective in sports hernia management in expression of decreasing pain and return to sports.

**Key words:** Sport hernia, visual analogue scale (VAS) and range of motion (ROM)

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# Scientific Conferences 2016

## Response of Diaphragmatic Excursion to Inspiratory Muscle Trainer Post Thoracotomy

**H. M. Haytham, E. A. Azza, E.S. Mohamed, E. G. Nesreen**

2016 West East Institute Rome International Academic Conference
**Type of Participation:** Search Study, International abstracts**.**

***Abstract*—Thoracotomy** is a great surgery that has serious pulmonary complications, so purpose of this study was to determine the response of diaphragmatic excursion to inspiratory muscle trainer post thoracotomy. Thirty patients of both sexes (16 men and 14 women) with age ranged from 20 to 40 years old had done thoracotomy participated in this study. The practical work was done in cardiothoracic department, Kasr-El-Aini hospital at faculty of medicine for individuals 3 days Post operatively. Patients were assigned into two groups: group A (study group) included 15 patients (8 men and 7 women) who received inspiratory muscle training by using inspiratory muscle trainer for 20 minutes and routine chest physiotherapy (deep breathing, cough and early ambulation) twice daily, 3 days per week for one month. Group B (control group) included 15 patients (8 men and 7 women) who received the routine chest physiotherapy only (deep breathing, cough and early ambulation) twice daily, 3 days per week for one month. Ultrasonography was used to evaluate the changes in diaphragmatic excursion before and after training program. Statistical analysis revealed a significant increase in diaphragmatic excursion in the study group (59.52%) more than control group (18.66%) after using inspiratory muscle trainer post operatively in patients post thoracotomy. It was concluded that the inspiratory muscle training device increases diaphragmatic excursion in patients post thoracotomy through improving inspiratory muscle strength and improving mechanics of breathing and using of inspiratory muscle trainer as a method of physical therapy rehabilitation to reduce post-operative pulmonary complications post thoracotomy.

***Keywords*—**Diaphragmatic excursion, inspiratory muscle trainer, ultrasonography, thoracotomy.

## Introduction

THORACIC surgeries may cause reduced respiratory function, pulmonary complications and increased risk of mortality,

morbidity. The risk of post-operative pulmonary complications is relatively high following thoracic surgery; rates have been recorded at between 19% and 59%, compared with only 16% and 17% for upper abdominal surgery and 0% and 5% for lower abdominal surgery. Post-operative physiotherapy aims to reverse atelectasis and secretion retention, and may include deep, and prolonged inspiratory efforts that are thought to reinflate collapsed alveoli, increase pulmonary compliance and reduces regional ventilation–perfusion inequalities [1].

Patients undergoing thoracotomy associated with lung resection are thought to be at high risk for the development of post-operative pulmonary complications (PPCs) during the post-operative period, and these complications may lead to serious morbidity [2].

Respiratory muscles are the only skeletal muscles vital to life. Surgical procedures can affect the respiratory muscles by a number of pathophysiological mechanisms including thoracoabdominal mechanics, reflexes, neuromechanical coupling, and loss of muscular integrity. Impairment of respiratory muscle function after surgery may lead to post-operative complications such as hypoventilation, hypoxia, atelectasis, and infections, some of which may be life threatening [3].

Only 2 hours of thoracic surgeries causes marked, and selective, diaphragm muscle fiber weakness. In all patients, the force-generating capacity of diaphragm muscle fibers was significantly reduced [4].

Dysfunction of the respiratory muscles is considered as the main cause of post-operative pulmonary complications, and can cause alveolar collapse that contributes to the formation of atelectasis leading to pulmonary infections. Inspiratory muscle training (IMT) appears to be an alternative to prevent these complications [5]. Inspiratory muscle training (IM training) is a technique that is designed to improve the performance of the respiratory muscles (RMs) that may be impaired in a variety of conditions [6]. Inspiratory muscle training (IMT) has been shown to improve inspiratory muscle function, lung volumes, work capacity, and power output in people who are healthy [7].

## Materials and Methods

**The study was conducted on 30 patients of both sexes (16 men and 14 women) after 3**

**days from thoracic surgery through thoracotomy. The patients were recruited from cardiothoracic department, Kasr –EL-Aini hospital at faculty of medicine, Cairo University. Clinically and medically stable patients with age of 20-40 years were included. Patients with a history of malignant disease, infection, medically unstable and other physical disorders may affect the result as obesity and smoking were excluded. The study was explained to the patients and their signed informed consent was taken. Patients were randomized into the following two groups: study group who received inspiratory muscle training in addition to postoperative routine chest physiotherapy in form of (deep breathing, coughing and early ambulation) (3 sessions per week twice daily for 1month) and control group who received postoperative routine chest physiotherapy in form of (deep breathing, coughing and early ambulation) (3 sessions per week twice daily for 1month).**

**Diaphragmatic excursion (the movement of the <u>diaphragm</u> during breathing) was measured during deep breathing while the patient in semi-recumbent position on a comfortable bed using ultrasonography by an ultrasound expert radiologist, postoperatively and also immediately at the end of the training program. Diaphragmatic excursion represents the distance difference between the same leading edge of the diaphragm at end expiration and end inspiration is calculated by M-mode tracing.**

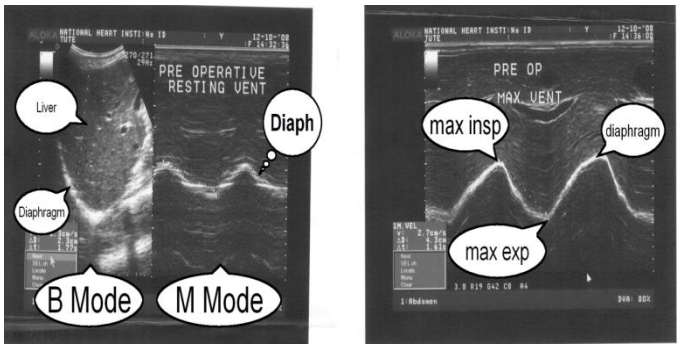


Fig. 1 Pre-operative left and post-operative right U/S showing the liver and diaphragm in the MCL with sub costal approach, toggled with M-mode of the same scanned media showing diaphragmatic motion (thick white line)

The control knob on the top of the inspiratory muscle training device was turned to align the red edge of the pressure indicator to the setting prescribed. The maximum training load was set; the patient identified the load at which they could successfully execute ten breaths at maximum

resistance depending on the patient's rate of perceived exertion. Training was started with a load equal to 30% of the patient's maximum inspiratory effort. This individualized load increase progressively as the inspiratory muscle became stronger and the recommended pressure load determined by the 30% maximum 10-repitition method by using IMT device [8].

The mouthpiece was attached to the device and put the nose clip on the patient's nose so that all of the breathing was done through the mouth and making sure the lips were sealed around the mouthpiece and the tongue not occlude it. The Patient was asked taking full breath in (maximal and deep inspiration) then longer and slow expiration through mouthpiece and continues this breathing pattern for 10-20 breath by inhalation and exhalation done through mouthpiece. The duration of treatment session was 10-15minutes with rest in between 30 second. The session was repeated three times/week twice daily for four weeks [9]. Group A and B received the traditional physical therapy program which includes deep breathing, cough and early ambulation [9].

## Results

The collected data were statistically analyzed using descriptive statistics (the mean and standard deviation). Descriptive statistics and t-test for comparison of the mean age of both groups, the paired t test was used to determine the significance level between pre and post physical therapy treatment. The unpaired t test was used to compare between both groups after treatment. The level of significance for all statistical tests was set at $p < 0.05$. All statistical measures were performed through the statistical package for social studies (SPSS) version 19 for windows.

Basic characteristic in form of age was gathered for each patient to calculate mean and standard deviation. The study group consisted of fifteen patients (8 men and 7 women), with an average age (29.53±5.26). On the other hand, the control group also consisted of fifteen patients (8 men and 7 women), with an average age (28.8±4.31) years old.

The result of this study has shown that diaphragmatic excursion in post thoracotomy patients significantly improved in the study group (A) post treatment in comparison with the control group (B) as shown in Table I.

Baseline clinical and demographic data were presented in Fig. 2. Of the variables presented, no pretreatment

differences were observed between the two groups.

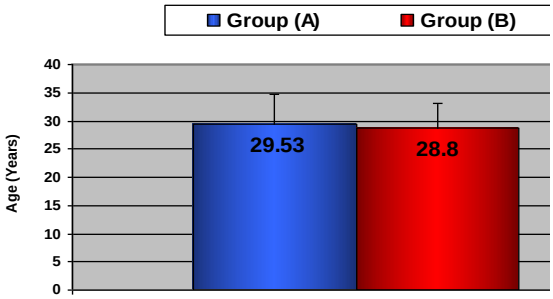


Fig. 2 Mean values of patients' the mean and ±SD of the age for group A and group B

As observed in Fig. 3, there was statistical significant improvement in mean value of patients for post- diaphragmatic excursion in study group A compared with Post-diaphragmatic excursion in control group B at entry of the study. The percentage of improvement in the study group post treatment was 59.52 % while for the control group was 18.66 % (P<0.05).

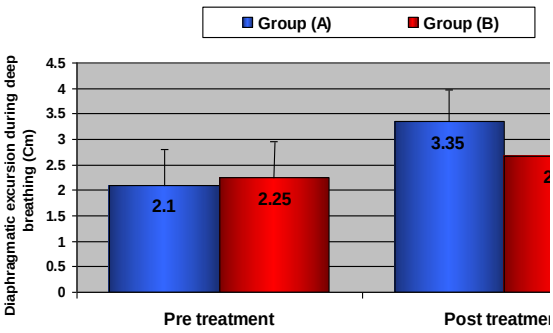


Fig. 3 Mean values of patient's diaphragmatic excursion of pre and post treatment for study group A and control group B

As observed in Fig. 4, there was no statistical significant difference in mean value of patient's post- diaphragmatic excursion between men and women in group A but there was statistical significant improvement in mean value of patients for post- diaphragmatic excursion compared with pre-diaphragmatic excursion in group A at entry of the study (P<0.05)

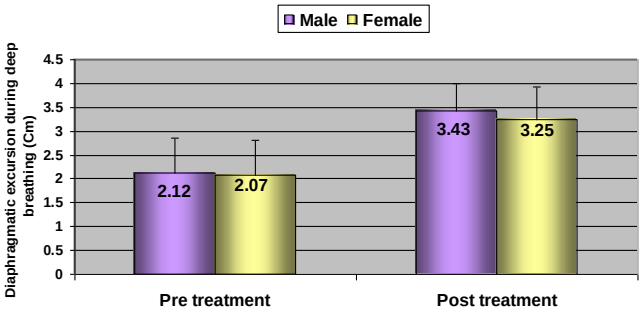


Fig. 4 Mean values of patient's diaphragmatic excursion of pre and post treatment for men and women in group (A)

As observed in Fig. 5, there was no statistically significant difference in mean value of patient's post-diaphragmatic excursion between men and women in Group B but there was statistical significant improvement in mean value of patient's post-diaphragmatic excursion compared with pre-diaphragmatic excursion in

group B at entry of the study (P<0.05)

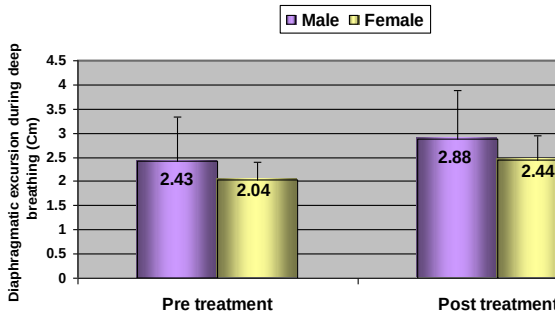


Fig. 5 Mean values of patient's diaphragmatic excursion of pre and post treatment for men and women in group (B)

TABLE I

MEANS, STANDARD DEVIATION AND PAIRED T-TEST FOR STUDY AND CONTROL GROUPS

| Groups | Diaphragmatic Excursion | | | |
|---|---|---|---|---|
| | Pre | Post | **T-Value** | **P-Value** |
| Study group | 2.1±0.71 | 3.35±0.61 | 19.39 | 0.0001 |
| Control group | 2.25±0.75 | 2.68±0.85 | 7.92 | 0.0001 |

## Discussion

Contrary to our hypothesis, we found that inspiratory muscle training has a significant effect on diaphragmatic excursion in post-thoracotomy patients in addition to improvement of mechanics of breathing which in turn help to reduce the severity of postoperative diaphragmatic dysfunctions. The analysis of the results of the current study showed that diaphragmatic excursion in post thoracotomy patients significantly improved in the study group (A) post treatment in comparison with the control group (B). This improvement in diaphragmatic excursion may be due to improvement of diaphragm mechanics, power and inspiratory muscle strength. Statistical significance was established at the conventional 0.05 level.

A controlled trial of IMT (pressure threshold) in 35 lung resection patients was taken. The IMT group (n=25) training for 20 minute per day, six times per weeks for one week pre-operative and 3 weeks post-operative, started with load of 30% MIP, exhibited a significant improvement in inspiratory muscle strength (70.36%) and reduction of post-operative atelectasis in study group more than control group [10].

Previous study revealed that IMT intervention improves exercise capacity and quality of life, particularly in patients with inspiratory muscle weakness. Some benefit from IMT may be accounted for by the attenuation of the inspiratory muscle metabolic reflex. Moreover, IMT results in improved cardiovascular responses to exercise and to those obtained

with standard aerobic training. [11].

In agreement with the results of the current study, it showed that most patients experience a reduction in inspiratory muscle function post-operative lobectomy, as well as a decline in lung function. They tested the hypothesis that IMT enhance inspiratory muscle strength and lung function both pre and post-operative. This improvement was also associated with significantly better lung function test results as compared with those in the control group of patients who were not given training [12].

The results of this study are coincided with result that examined effect of IMT on inspiratory muscle strength and post-operative pneumonia for patients undergoing pulmonary resection (n=40), training group (n=20) 15 minute daily, six time per week, training for 2 weeks pre-operative and 2 weeks post-operative, started by (20-30%) of MIP. Observed significantly increased in inspiratory muscle strength (67.39%) and reduce incidence of post-operative pneumonia in the training group more than control group [13].

The results of this study coincided results of a study found that six months of inspiratory threshold loading training, added to general exercise reconditioning, markedly improved inspiratory muscle strength and endurance, as well as exercise tolerance, in patients with COPD subjected to surgery, and that the improvement in this group of patients was significantly greater than that achieved with general exercise reconditioning alone [14].

It was approved that IMT device improve inspiratory muscle strength and endurance and account for an earlier recovery of pulmonary airflows in patients submitted to bariatric surgery [15].

## Conclusion

Our conclusion is to inspiratory muscle training has positive effects on diaphragmatic excursion in post-thoracotomy patients and IMT helps to restore inspiratory muscles strength which in turn helping of increase exercise tolerance.

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**Effect of Rehabilitation on Strength Ratio on Ankle Muscles in Adult**
**Aya Abd El-Hamid Mohamed Khalil**
The 10th International Society of Physical and Rehabilitation Medicine, ISPRM, Kualalumpur, Malaysian, May 29 – June 2, 2016.
**Type of Participation:** Search Study.

*The following benefits were acquired:*

**•At personal level**

-Communication with research from different scientific background.

-Improved personal and presentation skills

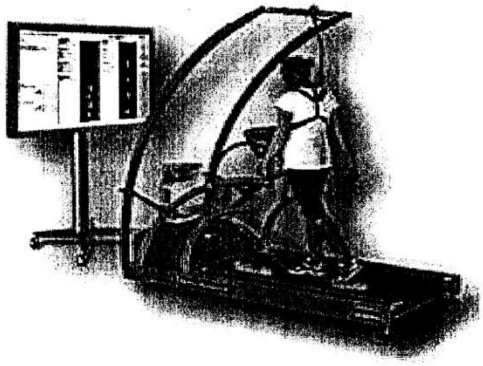
-Increase scope of research

-Enrich my scientific knowledge

-increase my self-confidence in my research ideas and work.

- update scientific knowledge about advanced instrumentation in assessment and rehabilitation.

**Instrumented h/p/cosmos treadmill – through the zebris medical pressure distribution platform**

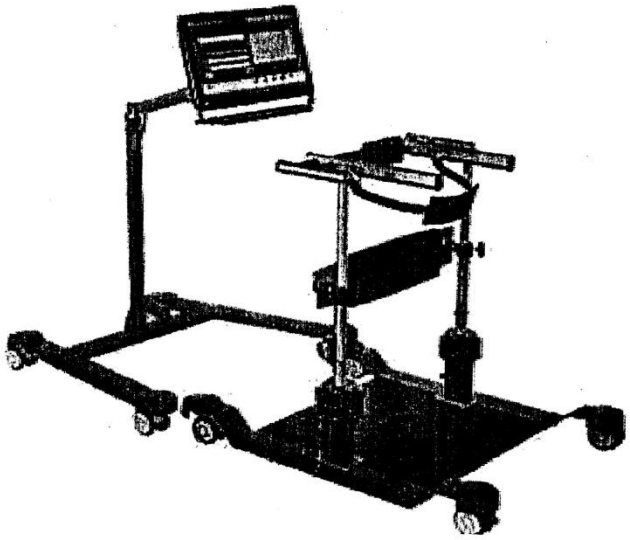


integrated instrumented pressure platform within the treadmill - detailed analysis of all gait parameters compatible with Simi Motion video analysis -visual stimulation for gait training – visual clues for patients projected onto treadmill, for example footsteps, blocks, dots, etc.

virtual training for improvement of cognitive skills and balance

**THERA- Trainer balo**

It is a dynamic standing and balancing trainer. Feet, legs and pelvis can be secured together or individually in almost any position depending on the exercise goal. The THERA-Trainer balo can also be adjusted to suit the needs of severely and critically affected patients (including those in a vegetative state).



**•At faculty level**

-Broaden scope of research through communication with researcher from different countries.

-Allocate faculty of physical therapy, Cairo University research level between several countries seeking improvement.

-Put faculty on the map of scientific research.

*The following workshops were presented in:*

**First day** 29/5/2016

Clinical Gait analysis

Assessment of swallowing problems

Musculoskeletal ultrasound (upper and lower limbs)

Non-invasive brain stimulation

Extracorporeal shock wave therapy in musculoskeletal disorders

*The following items were discussed in the conference sessions:*

**Second day** 30/5/2016

**•stroke**

-stroke rehabilitation role in cortical reorganization

- Knee hyperextension orthosis on lower extremity motor functions in individuals with stroke: a randomized controlled trail

**•Pain**

-Complex regional pain syndrome : an update

-Randomized controlled trial of cervical nerve root pulsed radiofrequency via posterior approach for the cervical radioculopathy.

**•Musculoskeletal condition**

-Physical activity in osteoporosis rehabilitation.

-Rheumatoid Hand Rehab steps.

**•Physical and rehabilitation medicine intervention**

-Ultrasound therapy versus extracorporeal shock wave therapy in treatment of plantar fascitis.

**PRM intervention**

Correlation of sonographic longitudinal-sagittal technique and transverse-axial technique of articular cartilage measurement in patients with knee osteoarthritis.

**Third day** 31/5/2016

**Traumatic brain injuries**

-The relationship between iq and cerebral metabolic rate of oxygen for traumatic brain injury with higher brain dysfunction

-Self-awareness of neuropsychological functioning at five years following traumatic brain injury

-The applicability of errorless learning strategy in neurological rehabilitation: a systematic review of clinical trials

**Back pain and spin disorders**

-Evidence based physical and rehabilitation medicine: conservative approach to adolescents with idiopathic scoliosis

-Role of gravity reduction therapy in management of prolapsed lumbar inter-vertebral disc

-Effectiveness of a research designed cost-effective lumbar brace as an adjunct in the treatment to patients with non-neurological low back pain

**Geriatric**

-Music therapy for geriatric rehabilitation

-Characteristics of falls in patients with hip fragility fractures in italy: the physiatric approach to osteoporosis 2 survey

-Are dietary supplements effective for musculoskeletal and cognitive functions in older people? a scoping review

-Computer-assistedcryotherapy in rehabilitation after total knee arthroplasty.

-Hypovitaminosis in patients with radial fractures

-Lower limb muscle reflex contraction latency, peak force and movement control in children with developmental coordination disorder.

-Lower limb muscle reflex contraction latency, peak force and movement control in children with developmental coordination disorder

-The cost and use of rehabilitation in patients with hemophilia a in taiwan: a nationwide population-based study

-Meeting global needs for cancer rehabilitation

-pesanserinus tendinitis/bursitis after total knee arthroplasty: mesotherapy treatment - our experience

-Performance of women with fibromyalgia in walking-up stairs while carrying a load

-The effectiveness of transforaminal epidural steroid injection in patients with radicular low back pain: combining the results with predictive value of pain provocation

**Fifth day** 2/6/2016

-ICF vocational rehabilitation core sets in SCI

-Practical considerations when selecting rehabilitation outcome measures

-Therapeutic applications of noninvasive brain stimulation in clinical neurorehabilitation

-Effects of low- and high-frequency repetitive magnetic stimulation on neuronal cell proliferation and growth factor expression: a preliminary report

-Clinical trial of baclofen and electrical stimulation in management of spasticity

-Disorders of attention, including neglect

-Disorders of consciousness in disaster rehabilitation

-New development in dysphagia management

-Does respiratory phase influence the anatomy of the pharynx and larynx? Analysis using 3d dynamic computed tomography

-Assessment of swallowing using high-resolution manometry.

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**Correlation between Functional Recovery and Cell Morphology Following Induced Tibialis Anterior Muscle Strain in Wister rats.**
**Tasneem Mohammad PT, MSc.**

ICORS Chinese, September 21−25, 2016.

**Type of Participation:** Search Study.

## INTRODUCTION

- **Muscle injuries are the most common sports injuries.**

  - ❑ **31% of all injuries.**
  - ❑ **27% of total absenteeism from games due to injury**.

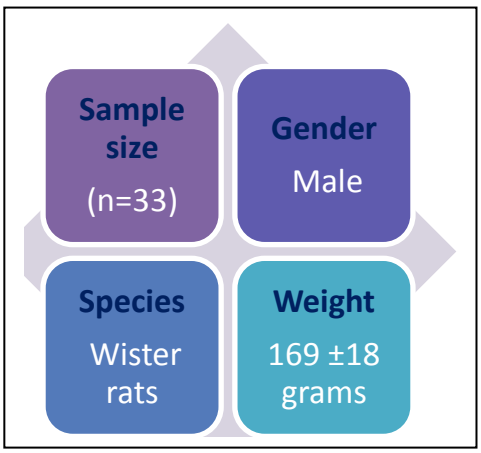
- **Sciatic Functional Index (SFI) is a valid method to assess lower limb recovery in rats after nerve or muscle injuries.**
- **Modified Movin score is a semi-quantitative 4-point scale to rate cell morphology.**

## OBJECTIVE

**To investigate the correlation between the functional recovery and the histological cell morphology of tibia lis anterior (TA) muscle.**

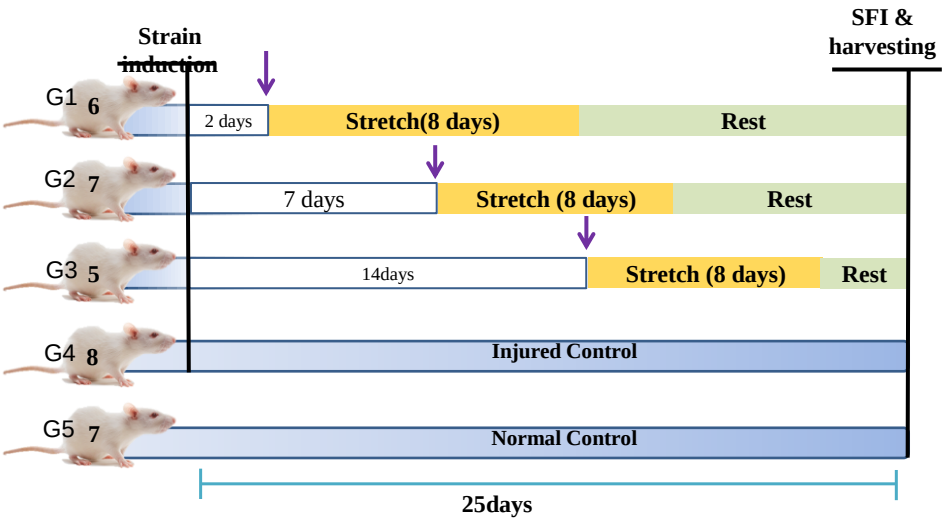
## Methods

## I. Animals



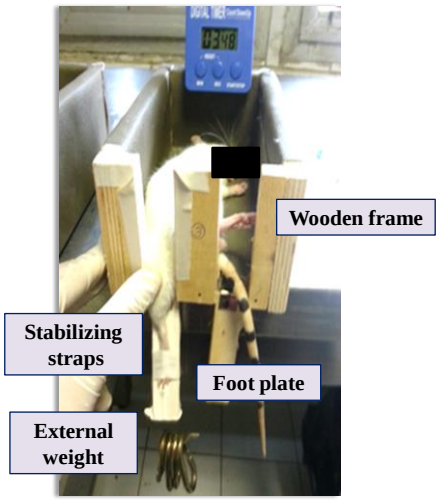
# Methods

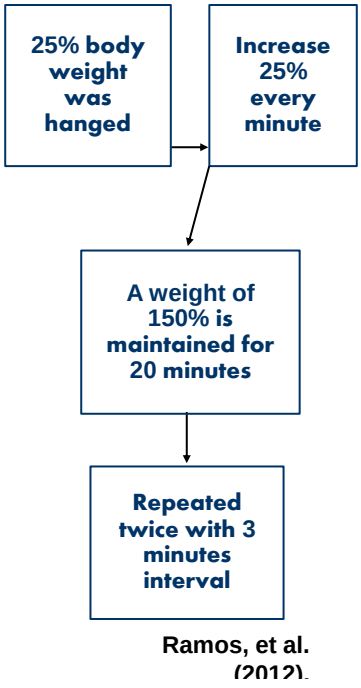
II .Timeline




# Methods

III. Strain induction




Ramos, et al. (2012).

## Methods

IV .Stretching

**Group I (**Stretching 1st week**)**

**Group II (**Stretching 2nd week**)**

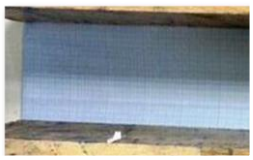
**Group III (**Stretching 3rd week**)**

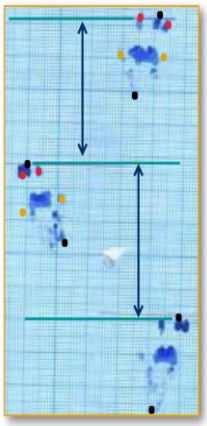
- Planter flexion & eversion
- 30 sec stretch, 30 sec rest

- 4 repetitions, once daily/8 consecutive days

## Methods

V .SFI





$$SFI^3 = -38.3 \frac{EPL-NPL}{NPL} + 109.5 \frac{ETS-NTS}{NTS} + 13.3 \frac{EIT-NIT}{NIT} - 8.8$$

**Bain, et al. (1989).**

## Methods

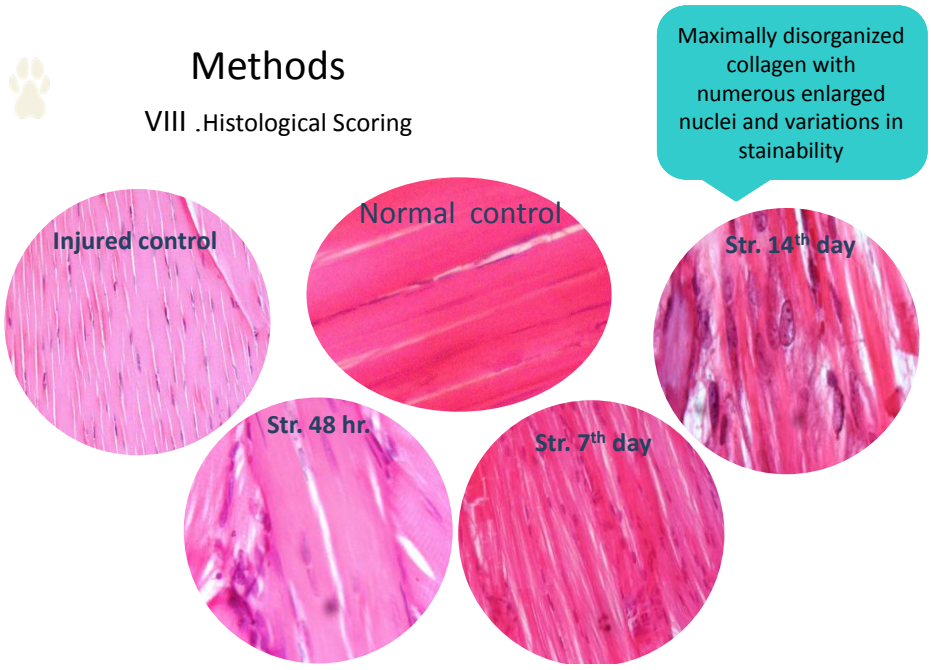
VI .SFI grading score

| Index Range | Functional Rate | Statistical Code |
|---|---|---|
| (12) ----- (-12) | Excellent | 5 |
| (-13) ----- (-37) | Good | 4 |
| (-38) ----- (-62) | Average | 3 |
| (-63) ----- (-87) | Unsatisfactory | 2 |
| (-88) ----- (-112) | Complete Deficit | 1 |
| (-113) ----- (-137) | Worse Than | 0 |

## Methods

VII .Histological Scoring

| Items | Score recorded for each item |
|---|---|
| **Fiber structure** | Normal (0)<br>Slightly abnormal (1)<br>Abnormal (2)<br>Markedly abnormal (3) |
| **Fiber arrangement** | |
| **Rounding of the nuclei** | |
| **Regional variations in cellularity** | |
| **Vascularity** | |
| **Decreased collagen** | |




## Conclusion

**Changes in function following strain induced muscle injury associated to somewhat with tissue structural changes.**

## Future directions

- **Correlate functional outcome with histomorphometric data.**
- **Investigate if the functional-histological correlation would be affected by healing stage.**


## Acknowledgement

- **A special thank you to Dr. Aliaa Rehan Youssef, Lecturer of Physical Therapy for Musculoskeletal Disorders and their Surgeries, Faculty of Physical Therapy, Cairo University; for her valuable and constructive contribution during the conception of the research idea, design and during the conduction of the study.**

- **Faculty of Physical Therapy, Cairo University for partially funding the study.**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# The Effect of Positional Release Technique versus Kinesio Tape on Iliocostalislumborumin Back Myofascial Pain Syndrome.

**Karem Mohamed Fouzy**, Allaa A. Balbaa, Ghada M. Koura, Ahmed Abdelazeem.

18th I.C.O.S.M. A.A.S. , USA, 25-26 April, 2016.

**Type of Participation:** Abstract.

**PURPOSE :** The purpose of this study was to compare between the effects of Positional Release Technique versus Kinesio Tape on pain level, pressure pain threshold level and functional disability in patients with back myofascial pain syndrome at iliocostalis lumborum.

**BACKGROUNDS/SIGNIFICANCE:**
Myofascial Pain Syndrome is a common muscular pain syndrome that arises from trigger points which are hyperirritable,painful and tender points within a taut band of skeletal muscle . In more recent literature, about 75%or patients with musculoskeletal pain presenting to a community medical centres suffer from myofascial pain syndrome.Iliocostalis lumborum are most likely to develop active trigger points.

**SUBJECTS :** Thirty patients diagnosed as back myofascial pain syndrome with active trigger points in iliocostalis lumborum muscle bilaterally had participated in in this study.

**METHODS AND MATERIALS:** Patients were randomly distributed into two groups. The first group consisted of 15 patients(8 males and 7 females) with mean age 30.6 (±3.08) years, they received positional release technique which was applied 3 times per session, 3/week every other day for 2 weeks. The second group consisted of 15 patients(5 males, 10 females) with a mean age 30.4 (±3.35) years, they received kinesio tape which was applied and changed every 3 days with one day off for a total 3 times in 2 weeks. Both techniques were applied over trigger points of the iliocostalis lumborum bilaterally. Patients were evaluated pretreatment and posttreatment program for Pain intensity(Visual analogue scale), pressure pain threshold(digital pressure algometry) and functional disability(The Oswestry Disability Index).

**ANALYSES :** Repeated measures MANOVA was used to detect differences within and between groups pre and post treatment .Then the univariate ANOVA test was conducted for the analysis of each dependant variable within and between groups. All statistical analyses were done using SPSS. with significance level set at $p<0.05$ through out all analyses.

**results:**
The results revealed that there was no significant difference between positional release technique and kinesio tape technique on pain level, pressure pain threshold and functional activities ($p>0.05$). Both groups of patients showed significant improvement in all the measured variables($p<0.05$) evident by significant reduction of both pain intensity and functional disability as well as significant increase of pressure pain threshold

**CONCLUSIONS :** Both positional release technique and kinesio taping technique are effective in reducing pain level, improving pressure pain threshold and improving function in treating patients who suffering from back myofascial pain syndrome at iliocostalis lumborum. As there was no statistical significant difference was proven between both of them

**FUNDING SOURCE :** Nothing to disclose

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# Scientific Conferences 2015

## Effect of Submaximal Eccentric versus Maximal Isometric Contraction on Del ayed Onest Muscle Soreness.

**Mohamed Marzok Mohamed, Mohamed M. Ragab, Neveen A. Abdel Raoof, Rehan H. Diab.**

ICPTRS, Malaysian, August 13-14, 2015.

**Type of Participation:** Study Search.

**Abstract**

**Background:** Delayed onset muscle soreness (DOMS) is the most common symptom when ordinary individuals and athletes are exposed to unaccustomed physical activity, especially eccentric contraction that impairs athletic performance. ordinary people work ability and physical functioning. Multitudes of methods have been investigated to reduce DOMS. One of the valuable method to control DOMS is repeated bout effect (RBE) as a prophylactic method. **Purpose:** To compare the repeated bout effect of submaximal eccentric withmaximal isometric contraction on induced DOMS. **Methods:** Sixty normal male volunteers were assigned randomly into three equal groups: Group A (first study group):20 subjects received submaximal eccentric contraction on non-dominant elbow flexors as a prophylactic exercise. Group B (second study group):20 subjects received maximal isometric contraction on non-dominant elbow flexors as a prophylactic exercise. Group C (control group):20 subjects did not receive any prophylactic exercises. Maximal isometric peak torque and patient related elbow evaluation (PREE) were measured for each subject 3 times before, immediately after and 48 hours after induction of DOMS. **Results:** Post-hoc test for maximal isometric peak torque and PREE scale immediately and 48 hours after induction of DOMS revealed that group (A) and group (B) resulted in significant decrease in maximal isometric strength loss and elbow pain and disability rather than control group (C), but submaximal eccentric group (A) was more effective than maximal isometric group (B) as it showed more rapid recovery of functional strength and less degrees of elbow pain and disability. **Conclusion:** Both submaximal eccentric contraction and maximal isometric contraction were effective in prevention of DOMS but submaximal eccentric contraction had the greatest protective effect.

**Key Words:** Delayed onset muscle soreness - Maximal isometric peak torque - Patient related elbow evaluation scale - Repeated bout effect.

## INTRODUCTION

Delayed onset muscle soreness is an exercise-induced phenomenon that is among the most common and recurrent forms of sport injury.[1] DOMS is the perception of discomfort and pain in the muscles in the days following unaccustomed physical activity, especially when eccentric contractions are involved.[2]

An unaccustomed exercise consisting of eccentric contractions induces muscle damage characterized by histological changes observed under light and (or) electron microscopy[3] and symptoms such as muscle weakness, DOMS, increased muscle stiffness and muscle swelling, as well as increase in muscle proteins such as creatine kinase (CK) and myoglobin (Mb) in the blood.[4]

Delayed onset muscle soreness is usually not present until 8-24 hours after exercise and peaks between 24 and 48 hours.[5]The symptoms then gradually disappear 5-7 days post exercise[1], in addition to muscle soreness and pain, functional strength is reduced.[6]

Muscle pain related to DOMS is evident throughout the muscle belly as well as at muscle-tendon junctions[7],and is experienced during contraction, stretching, or palpation of the muscle[8], greater manifestation of DOMS has been demonstrated near the muscle-tendon junction of the muscle, compared to the muscle belly.[9]

One of the symptoms of DOMS presents immediately after eccentric exercise is decrease in maximal force post exercise and in the days following unaccustomed eccentric exercise.[10]It has been suggested that both immediate mechanical disruption of muscle fibers and the accompanying inflammatory response is contributing to the force decline in the days following eccentric exercise.[11]However the precise pathology of DOMS and mechanisms responsible for the reduced muscle function after eccentric exercise are indefinite.

Because DOMS and mechanisms responsible for the reduced muscle function are only vaguely understood, a wide range of different strategies to reduce DOMS and enhance recovery from damaging exercise have been examined, researchers have implemented a variety of strategies in an attempt to alleviate DOMS, passive recovery strategies abound in the literature. Some examples are nutritional interventions[12],therapeutic modalities such asmassage[13], ultrasoundwaves[14]and heat.[15]

Additionally, active recovery has also been considered during the search for effective treatment strategies. Active recovery methods include light resistance training[16], high-intensity resistance training[17], aquatic exercise[18],warm-up and cool-down[19], whole-body vibration[20] and low-intensity aerobic exercise.[21]However, many of these demonstrate conflicting outcomes.

As DOMS is typically triggered by new and unaccustomed exercise, it can be minimized by previous introduction of that exercise known as the repeated bout effect.[22] Skeletal muscles quickly adapt with repeated exercise; however, if the individual does not continue to engage in the activity regularly, the muscle will lose it's recently acquired adaptations, causing it to become vulnerable again to eccentric muscle damage and DOMS.[23] Therefore the repeated bout effect can be considered one method of prevention.

Although DOMS can be induced in both athletes and untrained individuals[24], it is typically associated with unaccustomed high-intensity post physical activity, rather than with regular training, prior training attenuates DOMS and changes in performance occurring after an acute bout of exercise.[25]

It is known that a muscle is able to adapt to eccentric exercise so that a second period of the same or similar exercise is accompanied by much less soreness and stiffness and a more rapid recovery of strength.[26]This training effect is accompanied by a shift of the length– tension curve in the direction of longer muscle length as a result of incorporation of extra sarcomeres in muscle fibers.[27]So it is proposed that there are two shifts in the active length–tension relation of muscle following unaccustomed eccentric exercise, the first shift is due to the presence of damage and the second shift is due to an adaptation response.

Furthermore, the intensity of DOMS has been found to correlate with the intensity of the related exercise bout.[28]When a subsequent bout of the same or similar eccentric exercise is performed, the changes in the muscle damage markers are attenuated and recovered to the baseline.[2]

Recent studies showed that maximal isometric contractions at a long muscle length would attenuate muscle damage induced by the maximal eccentric exercise[2], and how low-intensity eccentric contractions or maximal isometric contractions performed at different muscle lengths would influence the repeated bout effect.[28]

The length of this protective effect may be relatively short lived. Performance of a single eccentric exercise bout has been shown to reduce muscle soreness after a similar exercise bout from 24 hours[29]up to 6 weeks but not beyond 9weeks.[30]

There are so many variables that guide the RBE study, such as different types of people, different exercises since its intensity, volume, and induction for being eccentric or isometric, sub maximal or maximum, interval between sessions. Accordingly, the purpose of the current study was to compare the repeated bout effect of submaximal eccentric contraction versus maximal isometric contraction on the magnitude of eccentric exercise – induce delayed onset muscle soreness.

## SUBJECT AND METHODS

### Subjects

This study was conducted in the isokinetic laboratory at Faculty of Physical Therapy, Cairo University, in the period from June 2014 to November 2014 to compare the repeated bout effect of submaximal eccentric contraction versus maximal isometric contractionon induced delayed onset muscle soreness. Participants were selected by using randomized sampling from the students of Faculty of Physical Therapy, Cairo University.

Sixty normal male subjects participated in this study and were randomly assigned by closed envelops method into three groups of equal number: Group (A) "experimental group": 20 subjects received submaximal eccentric contraction on non-dominant elbow flexors as prophylactic exercise. Group (B) "experimental group":20 subjects received maximal isometric contraction on non-dominant elbow flexors as prophylactic exercise. Group (C)"control group":20 subjects did not receive any prophylactic exercise.

### Design of the Study

Repeated measure study design was conducted.

### Selection of Subjects

Sixty normal male volunteers from the students of Faculty of Physical Therapy, Cairo University. Only males were included and participated in the study after signing an institutionally approved informed consent form prior to data collection. Their age ranged from 20 to 30 years old with a mean age of 24.85$\pm$2.74 years, height ranged from 165 to 190 cm with a mean height of 175.15$\pm$5.21cm and weight ranged from 62 to 91 kg with a mean weight of 76.17$\pm$6.75 kg. The exclusion criteria for participants were recent shoulder or elbow operation, using of anti-inflammatory drugs and previous history of muscles, joint or bone injuries of the upper limb.

**Instrumentations and Tools**

(1) Isokinetic machine for measuring maximal isometric peak torque of non-domiant elbow flexors.
(2) Patient Related Elbow Evaluation scale for measuringelbow pain and disability in activities of daily living.
(3) Dumbbells for applying prevention exercise on non-dominant elbow flexors.
(4) Weight and height scale for measuring the subjects' weight and height.

**Procedures**

The following data were recorded at the beginning of the study (information sheet): Personal data name, height, age, weight, telephone number,Explanation of the whole study for each subject and any possible complication or risk, then the subjects signed a consent form. This study consists of 3 phases: prophylactic exercises, induction of DOMS, measurements before and after induced DOMS.

**1) Group (A):**

- **Prophylactic exercise:**

The subjects in the first experimental group (n=20) performed submaximal eccentric contraction on the elbow flexors of the non-dominant arm two days prior to maximal eccentric exercise (induction of DOMS).

Each Subject in the study group started to warm up for 5 minutes, After warming up the one repetition maximum through 3 to 5 subject maximum concentric contraction of elbow flexors of the non-dominant arm was estimated.

The subjects in the group were sit on a chair and 50 eccentric contractions of 80% 1RM for 5 sets of 10 repetition was done using dumbbell. Each set includes 10 contractions that lower a person's weight from (90◦) elbow flexion as starting position to full elbow extension as end position in 3 seconds and At least 2 seconds to reach the next contraction without weights placed in full flexion. One minute rest was given between each set.

Maximal isometric contraction peak torque of elbow flexors as marker of muscle damage and Elbow pain and disability in daily activities (PREE scale) were measured for each subject after the prevention exercise and before induction of DOMS as baseline measurements.

The method involves maximal voluntary contraction (MVC) of elbow flexors at a fixed joint angle (90°), Subjects were verbally encouraged to perform three maximal contractions, holding each contraction for 5 s and were allowed 5 s of passive rest between each effort. The peak torque of the three contractions was averaged

Elbow pain and disability in daily activities (PREE scale) were measured for each subject through a 20–item questionnaire and subjects rated their levels of elbow pain and disability from 0 to 10.

- **Induction of DOMS:**

Subjects in the first experimental group who performed submaximal eccentric exercise as a prophylactic were engaged in maximal eccentric contractions protocol on isokinetic dynamometer to induce delayed onset muscle soreness.

The Biodex system was started and then calibration was done prior to each testing session. Each subject was seated upright on a chair with the backrest angle at 90° and his chest and waist were immobilized by straps, placing the upper arm

on a padded support that secured the shoulder joint angle at 45° flexion and 0° abduction. The elbow joint was set at 90° with the forearm in a fully supinated position, the axis of rotation of the right elbow (lateral epicondyle of the humerus) was aligned with the axis of rotation of the dynamometer. The load cell assembly was attached to the distal forearm via a wrist cuff and the upper arm was secured in place through the use of Velcro straps.

The eccentric exercise consisted of five sets of six maximal eccentric contractions of the elbow flexors at an angular velocity of 90°·s–1 from a half-flexed position (90°) to a fully extended positionon the isokinetic dynamometer.

Each contraction lasted for 3 s and was repeated every 10 s during which the isokinetic dynamometer passively returned the elbow joint to the flexed position at the velocity of 9°·s–1, with a 2-min rest between sets. Subjects were verbally encouraged to maximally resist the movements of the isokinetic dynamometer to extend the elbow joint.

- **Measurements nafter induction of DOMS:**

**A.** Maximal isometric contraction peak torque measurements were repeated Immediately after induction of DOMS and 48 hours after induction of DOMS as comparable measurements with baseline measurements using isokinetic dynamometer as before induction of DOMS.

**B.** Elbow pain and disability in daily activities were measured immediately after induction of DOMS and 48 hours after induction of DOMS using the PREE scale through a 20–item questionnaire, and subjects rated their levels of elbow pain and disability from 0 to 10.

**2) Group (B):**

- **Prophylactic exercise:**

The subjects in the second experimental group (n=20) performed maximal isometric contractions on elbow flexors of non-dominant arm two days prior to maximal eccentric exercise (induction of DOMS).

Each Subject in the study group start to warm up for 5 minutes, after warming up the one repetition maximum through 3 to 5 subject maximum concentric contraction in the non-dominant arm was estimated.

Each subject in the second study group were sit on chair and 5 sets of 10 maximal isometric contractions of the elbow flexors was done respectively, at an elbow angle of 20° elbow flexion (full elbow extension = 0°).

Maximal isometric contraction peak torque of elbow flexors as marker of muscledamage and Elbow pain and disability in daily activities (PREE scale) were measured for each subject after the prevention exercise and before induction of DOMS as baseline measurements as discussed in the first study group.

- **Induction of DOMS:**

Subjects in the second experimental group who performed submaximal eccentric exercise as a prophylactic were engaged in maximal eccentric contractions protocol on isokinetic dynamometer to induce delayed onset muscle soreness the same maximal eccentric protocol as discussed before in the first study group.

- **Measurements after induction of DOMS:**

**A.** Maximal isometric contraction peak torque measurements wererepeated immediately after induction of DOMS and 48 hours after induction of DOMS as comparable measurements with baseline measurements using isokinetic dynamometer.

**B.** Elbow pain and disability in daily activities was measured immediately after induction of DOMS and 48 hours after induction of DOMS using the PREE scale through a 20–item questionnaire and subjects rated their levels of elbow pain and disability from 0 to 10.

**3) Group (C):**

- **Prophylactic exercise :**

The subjects in the third control group (n=20) did not perform any prophylactic exercises.

Maximal isometric contraction peak torque as marker of muscle damage and Elbow pain and disability in daily activities (PREE scale) were measured for each subject before induction of DOMS as baseline measurements.

- **Induction of DOMS :**

Subjects in the control group who did not perform any prophylactic were engaged in maximal eccentric contractions protocol on isokinetic dynamometer to induce delayed onset muscle soreness as the previous two study groups.

- **Measurements after induction of DOMS :**

**A.** Maximal isometric contraction peak torque measurements were repeated immediately after induction of DOMS and 48 hours after induction of DOMS as comparable measurements with baseline measurements using isokinetic dynamometer.

**B.** Elbow pain and disability in daily activities were measured immediately after induction of DOMS and 48 hours after induction of DOMS using the PREE scale through a 20–item questionnaire and subjects rated their levels of elbow pain and disability from 0 to 10.

**Data Collection and Statistical Analysis**

Each participants underwent (1) Maximal Isometric contraction peak torque measurement on isokinetic dynamometer. (2) Rating their degree of elbow pain and function in PREE scale. Measurements were conducted before induction of DOMS, immediately after induction of DOMS, 48 hours after induction of DOMS.

A. Descriptive statistics: The mean and the standard deviation were calculated for (1) Maximal isometric peak torque of elbow flexors and (2) Patient related elbow evaluation scale among the three groups.

B. A repeated measure analysis of variance (ANOVA) used to measure statistical difference among the three groups. Comparisons among groups at points in time are made to determine the statistical difference among the three groups in the mean value of maximal isometric peak torque of elbow flexors and PREE scale using Tukey's post-hoc test(Least square difference (LSD) test) was performed ($P<0.05$).

## RESULTS

**1) Participants Characteristics**

Sixty male subject participated in this study. Their ages ranged from 20 to 30 years with a mean age of 24.85±2.74 years, their weight ranged from 62 to 91 with a mean weight of 76.17±6.75 kg and their height ranged from 165 to 190 with a mean height of 175.15±5.21cm. The patients were assigned randomly into three equal groups. The participants are summarized in table (1).

**Table (1): Demographic and baseline characteristics of participants**

| Variables | Group A | Group B | Group C | Comparison | | Significance |
|---|---|---|---|---|---|---|
| | Mean ± S.D | Mean ± S.D | Mean ± S.D | f-value | p-value | |
| Age (Years) | 24.6±2.77 | 24.75±2.78 | 25.2±2.76 | .253 | .778 | N.S |
| Weight (Kg.) | 77.8±6.88 | 76.1±5.15 | 75.1±6.50 | .961 | .389 | N.S |
| Height (Cm.) | 177.2±6.66 | 176.6±4.23 | 173.8±6.23 | 1.950 | .152 | N.S |

***N.S: Not significant S.D: Standard deviation P: probability value***

***F: Anova test***

## II) Results of Peak Torque of elbow flexors:

- There were no significant differences between the three groups concerning age, weight and height.
- Repeated measure ANOVA revealed that there was no significant difference among the three groups in maximal isometric peak torque for the pre induction of DOMS value as (F =0.747, P =0.478). While there was significant difference for the immediately after induction of DOMS value as (F=10.276, P =0.0001), and finally there was a significant difference for 48 hours after induction of DOMS value as (F =31.967, P =0.0001), table (2).

**Table (2): Results of ANOVA among the three groups for peak torque (Nm.)**

| Peak torque | | SS | MS | F | P value | S |
|---|---|---|---|---|---|---|
| Pre induction of DOMS | among Groups<br>Within Groups<br>Total | 40.26<br>1536.51<br>1576.77 | 20.130<br>26.956 | 0.74 | 0.478 | NS |
| Immediately after induction of DOMS | among Groups<br>Within Groups<br>Total | 442.58<br>1227.46<br>1670.04 | 221.29<br>21.534 | 10.27 | 0.0001 | S |
| 48 hours after induction of DOMS | among Groups<br>Within Groups<br>Total | 1426.71<br>1271.60<br>2698.32 | 713.35<br>22.30 | 31.96 | 0.0001 | S |

***SS: Sum of Square MS: Mean Square P: probability S: significance**
**S: Significant N.*S: Not significant***

- **Post-hoc Test for peak torque:** Post-hoc test was performed to determine the difference among the groups in the mean value of the peak torque. For immediately after induction of DOMS there was a significant difference between groups A and B (mean difference=3.49, P=0.021), between groups A and C (mean difference=6.65, P=0.0001) and finally between groups B and C (mean difference=3.16, P =0.036), table (3) and figure (1) and for 48 hours after induction of DOMS there was a significant difference between groups A and B (mean difference=3.215, P=0.036), between groups A and C (mean difference=11.57, P=0.0001), and finally between groups B and C (mean difference= 8.355, P =0.0001), table (3) and figure (2)

**Table (3): Post hoc test among the three groups for peak torque (Nm.)**

| Peak torque | | Mean difference | P value | S |
|---|---|---|---|---|
| **Immediately after induction of soreness** | Group A vs. group B | 3.49 | 0.021 | S |
| | Group A vs. group C | 6.65 | 0.0001 | S |
| | Group B vs. group C | 3.16 | 0.036 | S |
| **48 hrs. after induction of soreness** | Group A vs. group B | 3.21 | 0.036 | S |
| | Group A vs. group C | 11.57 | 0.0001 | S |

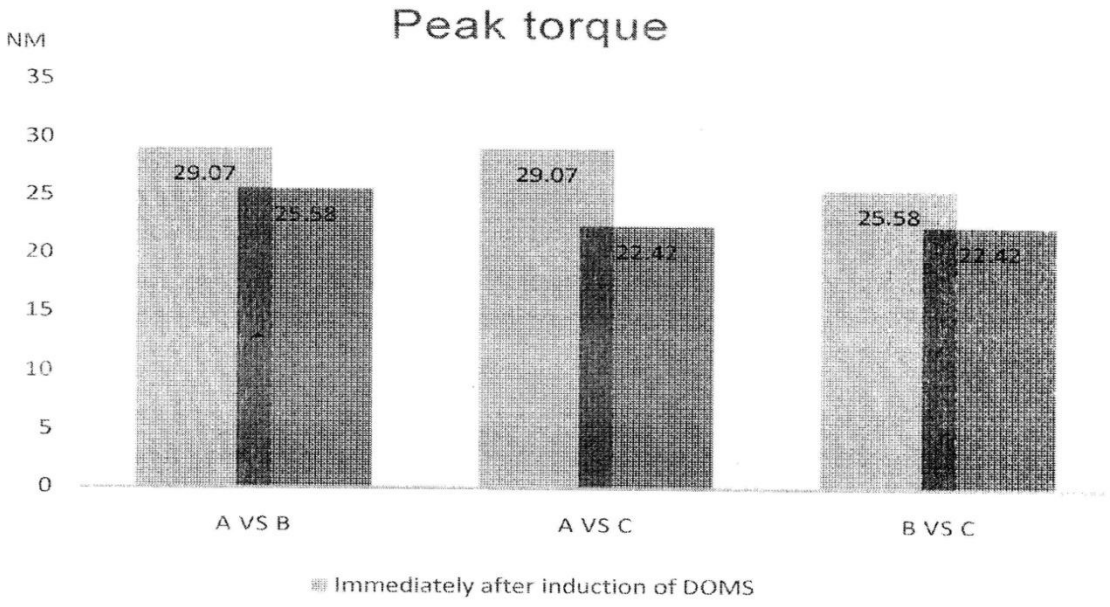



**Fig. (1): Post-hoc Test for peak torque: immediately after induction of DOMS for groups A, B, C.**

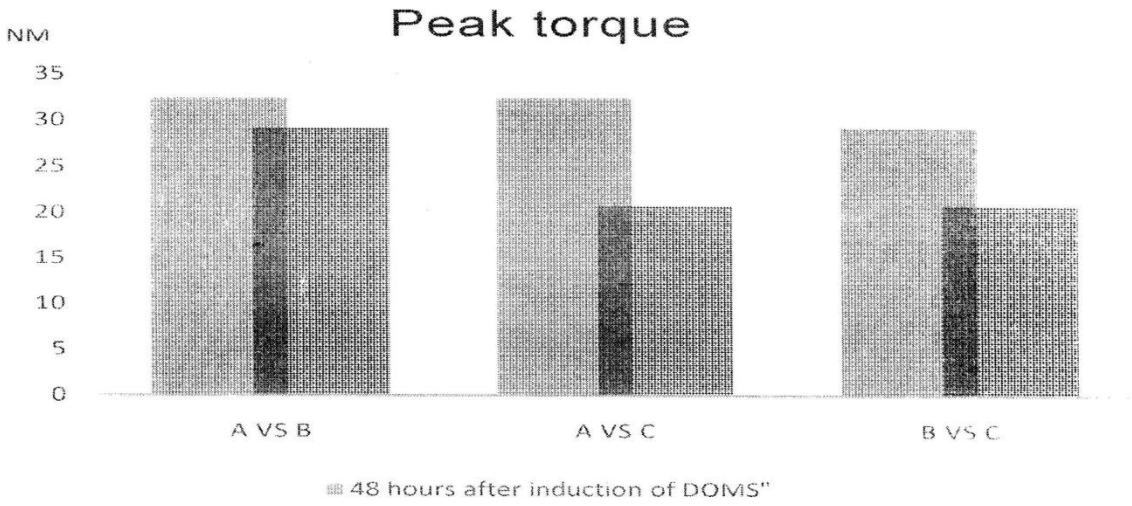



**Fig. (2): Post-hoc Test for peak torque: 48 hours after induction of DOMS for groups A, B, C.**

### III) Patient Related Elbow Evaluation Scale:

- Repeated measure ANOVA revealed that there was no significant difference among the three groups among the PREE Scale for the pre induction of DOMS value (F=.290, P=.750).While there was a significant difference for the immediately after induction of DOMS value (F=11.117, P=0.0001), and finally, there was a significant difference for 48 hours after induction of DOMS value (F=94.305, P=0.0001), table (4).

**Table (4): Results of ANOVA among the three groups for PREE Scale.**

| PREE SCALE | | SS | MS | F | P value | S |
|---|---|---|---|---|---|---|
| **Pre induction of DOMS** | among Groups<br>Within Groups<br>Total | 1.73<br>170.60<br>172.33 | o.867<br>2.993 | .290 | .750 | NS |
| **Immediately after induction of DOMS** | among Groups<br>Within Groups<br>Total | 1525.43<br>3910.75<br>5436.18 | 762.717<br>68.610 | 11.11 | 0.0001 | S |
| **48 hours after induction of DOMS** | among Groups<br>Within Groups<br>Total | 12825.83<br>3876.10<br>16701.93 | 6412.917<br>68.002 | 94.30 | 0.0001 | S |

***SS: Sum of Square MS: Mean Square P: probability S: significance***
***S: Significant N.S: Not significant***

**Post-hoc Test for PREE Scale:**

Post-hoc test was performed to determine the difference between the three groups in the mean value of the PREE scale. For immediately after induction of DOMS there was a significant difference between groups A and B (mean difference= -6.30, P=0.019), between groups A and C(mean difference= -12.35, P=0.0001), and finally, between groups B and C (mean difference= -6.05, P =0.025),table (5) and figure (3), and for 48 hours after induction of DOMS there was a significant difference between groups A and B (mean difference= -6.5, P=0.016), between groups A and C (mean difference= -33.75, P=0.0001), and finally between groups B and C (mean difference= -27.25, P =0.036), table (5) and figure (4).

**Table (5): Post hoc test among the three groups for PREE scale**

| PREE SCALE | | Mean difference | P value | S |
|---|---|---|---|---|
| **Immediately after induction of DOMS** | Group A vs. group B | -6.30 | .019 | S |
| | Group A vs. group C | -12.35 | 0.0001 | S |
| | Group B vs. group C | -6.05 | 0.025 | S |
| **48 hours after induction of DOMS** | Group A vs. group B | -6.5 | 0.016 | S |
| | Group A vs. group C | -33.75 | 0.0001 | S |
| | Group B vs. group C | -27.25 | 0.0001 | S |

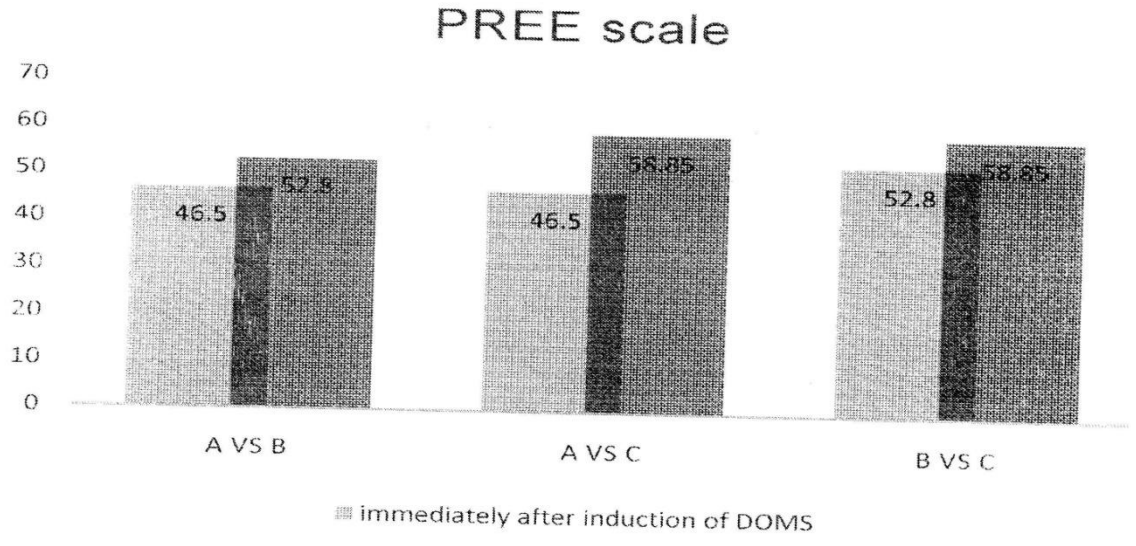
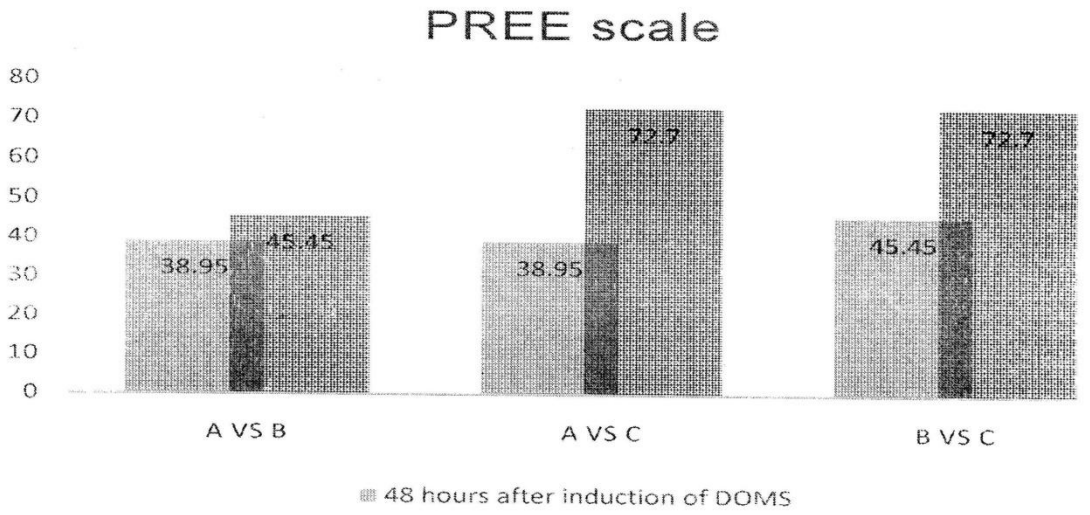



**Fig. (3): Post-hoc Test for PREE scale: immediately after induction of DOMS for groups A, B, C.**




## DISCUSSION

The purpose of this study was to compare the repeated bout effect of submaximal eccentric contraction versus maximal isometric contraction on delayed onset muscle soreness.

Delayed onset muscle soreness as presented in literatureis common when ordinary individuals and athletes are first introduced to certain types of activities which could deter a deconditioned individual from continuing a new exercise program and could also cause new exercises to be unappealing. A wide range of different strategies to reduce DOMS and enhance recovery from damaging exercise have been examined. However, the prevention of DOMS may be advantageous for the adherence to an exercise protocol. To date, the best way to prevent DOMS has been to produce minimal muscle damage with a prior bout of similar exercise which known as repeated bout effect.[31]

In this study sixty normal male subjects were assigned randomly into three equal groups, two study groups and one control group, the first study group performed only submaximal eccentric contraction as prevention exercise, the second study group performed only maximal isometric contraction as prevention exercises and the third control group did not perform any prevention exercise. Maximal isometric peak torque and patient related elbow evaluation scale were measured before, immediately after and 48 hours after induction of maximal eccentric exercise protocol on isokinetic to induce DOMS and were used as comparable measurements.

**The results among the 3 groups:**

The finding of the current study revealed that there was a significant difference in maximal isometric peak torque and PREE scale among the three groups for the immediately after induction of DOMS value and 48 hours after induction of DOMS value.

The results showed that submaximal eccentric group (A) was more effective than control group (C) on DOMS as there was a significant difference between both groups for the maximal isometric peak torque as the mean difference value was

6.65 and P-value was 0.0001 immediately after induction of DOMS and the mean difference value was 11.57 and P-value was 0.0001 forty eight hours after induction of DOMS, also there was a significant difference between both groups for the PREE scale as the mean difference value was -12.35 and P-value was 0.0001 immediately after induction of DOMS and the mean difference value was -33.75 and P-value was 0.0001 forty eight hours after induction of DOM. which was agreed by **Starbuck and Eston(2012)** who reported that muscle function was improved and Muscle pain (34 cf ≈ 19 mm) was lower after second attack of maximal eccentric exercises ($p < 0.05$) when bout of eccentric exercises performed prior to maximal eccentric exercises.[32]

These results also supported by **Chan et al.(2012)**who investigated whether a repeated series of various settings would result in difference in magnitude of muscle damage after the first and second exercise sessions. Ten untrained men underwent two sessions of eccentric exercise of the elbow flexors in each arm (4 sets in total) with sessions separated by 4 weeks. The results showed that range of motion (ROM), cross-sectional area of the biceps and DOMS changed significantly ($p < 0.05$) after exercise.[33]

Also, **Aldayelet al.(2010)**showed that changes in indirect markers of muscle damage such as muscle soreness and pain were attenuated after the second bout which was performed 2 weeks after an initial bout. It has also been reported that submaximal non-damaging eccentric contractions induced protective effect against higher intensity eccentric contractions.[34]

Additionally, our results agreed with **Howatson et al.(2007)**who hypothesized that an eccentric exercise session with a high or low volume protects against muscle damage after a high volume in the series and subsequent adaptation. Sixteen men performed either 45 eccentric contractions (ECC45) or 10 (ECC10) maximum eccentric contractions using the elbow flexors. This was followed by a session ECC45 two weeks later, session ECC45 maximum eccentric exercise induced more damage than an initial attack ECC10 maximum eccentric exercise; however, both conferred protection from subsequent ECC45 maximum eccentric contractions and reduced muscle pain, muscle soreness.[35]

In addition to **chen et al.(2007)** who suggested that When comparing the effect of four different intensities (40%, 60%, 80% and 100%) of initial eccentric exercise on the extent of muscle damage induced by subsequent maximal eccentric exercise performed later, all submaximal intensity eccentric exercise reduced the magnitude of muscle damage following the maximal eccentric exercise, but the magnitude of repeated bout effect was significantly greater for 80% and 100%.[36]

Also, our results agreed with **Chen and Nosaka(2006)**who compared the changes in indirect markers of muscle damage after eccentric exercise of the elbow flexors with different eccentric actions, the results showed that maximal isometric force (MIF) decreased significantly ($p<0.01$) to approximately 60% of pre-exercise levels immediately after ECC1 and recovery of about 70% based on three ECC1 days later for all groups, This suggested that repeated bout of eccentric exercise enhanced the recovery of muscle damage after second session of maximal eccentric exercise performed 3 days later regardless number of exercise repetitions in the initial session.[37]

These finding agreed with those obtained by **Nosaka et al.(2005)**who reported thateccentric contractions at long muscle lengths induce greater muscle damage than eccentric contractions at short muscle lengths, they found that the eccentric exercise at the long muscle length (100-180°, full extension: ~180°) produced a

greater protective effect against muscle damage induced by maximal eccentric exercise performed 2 weeks later.[38]

Additionally, the results showed that maximal isometric group (B) was more effective than control group (C) on DOMS as there was a significant difference between both groups for the maximal isometric peak torque as the mean difference value was 3.16 and P-value was 0.036 immediately after induction of DOMS and the mean difference value was 8.355 and P-value was 0.0001 forty eight hours after induction of DOMS, also there was a significant difference between both groups for the PREE scale as the mean difference value was -6.05 and P-value was 0.025 immediately after induction of DOMS and the mean difference value was -27.25 and P-value was 0.0001 forty eight hours after induction of DOMS.

These results are in consistent with those reported by **Mackey et al.(2011)**who have recently showed that the extracellular matrix is strengthened following 180 isometric contractions evoked by electrical stimulation, and that muscle soreness in the subsequent bout that was performed 28 days later was attenuated.[39]

Also this concept was supported by **Nosaka(2009)**who stated that maximal isometric contractions at a long muscle length (160°) but not at a short muscle length (90°) conferred protective effect against maximal eccentric exercise performed 2 weeks later This suggests that not only eccentric contractions but also isometric contractions at a long muscle length produce protective effect against muscle damage induced by eccentric contractions.[40]

These results were also supported by **Philippou et al.(2004)** who reported that two sets of 25 maximal isometric contractions of the elbow flexors at a long muscle length (40° elbow flexion) resulted in a significant shift of optimum angle to a longer muscle length, decreases in maximal voluntary isometric strength, and relaxed elbow joint angle, as well as development of muscle soreness.[41]

Furthermore, **Philippou et al.(2003)**reported that 50 maximal voluntary isometric contractions of the elbow flexors at the elbow joint angle of 140° resulted in a significant reduction of maximal voluntary contraction (MVC) strength loss (16% at 140° elbow angle at 24 h).[42]

Finally, the results showed that submaximal eccentric group (A) was more effective than maximal isometric group (B) on DOMS as there was a significant difference between both groups for the maximal isometric peak torque as the mean difference value was 3.49and P-value was 0.021 immediately after induction of DOMS and the mean difference value was 3.215 and P value was 0.036 forty eight hours after induction of DOMS, also there was a significant difference between both groups for the PREE scale as the mean difference value was 6.30 and P-value was 0.019 immediately after induction of DOMS and the mean difference value was 6.5 and P-value was 0.016forty eight hours after induction of DOMS.

These results were supported by **Chen et al.(2012)** who investigated how submaximal intensity eccentric contractions or maximal isometric contractions performed at different muscle lengths would influence the repeated bout effect. Subjects were placed into one of five groups and during the first exercise bout performed 30 contractions of either maximal eccentric actions, 10% of maximal voluntary isometric contractions (MVIC) eccentric exercise, 20% MVIC eccentric exercise, 90 degrees maximal isometric contractions, or 20 degrees maximal isometric contractions.. Three weeks later all groups performed maximal eccentric actions. The greatest protection occurred when the maximal eccentric actions (64-

98%) were performed at the first bout. After that, the largest protection was produced by the 20 degree maximal isometric contractions (27-63%) then 20% MVC eccentric actions (17-55%), 10% MVC eccentric contractions (0%-36%) and lastly the 90 degree maximal isometric contractions (0%-11%).[28]

The current results are in consistent with those reported by **chen et al.(2012)**who documented that one of the potential cellular adaptations for the protective effect is a longitudinal addition of sarcomeres, and this theory was indirectly supported by a shift in optimum angle to a longer muscle length. However, the maximal isometric contractions in previous studies did not shift the peak torque (optimum) angle, If a shift of peak torque angle is a sensitive marker of changes in sarcomere number in series, the longitudinal addition of sarcomeres does not appear to be occurred with isometric contractions, so the submaximal eccentric exercises was more effective the maximal isometric contractions in prevention of induced DOMS.[28]
This also supported by **Marc et al.(2011)**who found that both maximal voluntary and electrical stimulation-evoked isometric contractions of the elbow flexors at a long muscle length resulted in moderate but significant protection of muscle damage but less than high intensity eccentric contractions, they demonstrated that repeated maximal voluntary isometric contractions at a long muscle length (160°) resulted in small but significant decreases in MVC strength and ROM, and increases in muscle soreness and tenderness.[43]
Also, **Lavender and Nosaka(2008)** reported that repeated bout of non-damaging low intensity eccentric or maximal isometric exercises can provide a protective effect against muscle damage but less than maximal high intensity eccentric exercise. It seems that the combination of the first 40% ECC bout that resulted in minor damage and the second to fourth 40% ECC bouts that resulted in little or no damage provided the same magnitude of protective effect as one bout of 100% ECC.[25]

This supported by **Koh and Brooks(2001)** who reported that eccentric or lengthening contractions and muscle fiber degeneration are not required to induce protection against eccentric-induced muscle injury .This demonstrates that an acute non-eccentrically biased exercise of a low stimulus can induce adequate adaptation against subsequent injurious eccentric exercises but with less protection effect than submaximal eccentric exercises. Thus, acute exercises of non-eccentrically biased or having the same amounts of eccentric as maximal isometric contraction can be performed to induce protection in the skeletal muscles. This finding makes the stimulus of these non-eccentrically biased exercises appropriate given that less muscle soreness was reported in the repeated exercise. Thus, the repeated bout effect can be produced with non-injurious and low stimulus acute exercises. This approach will reduce muscle soreness and, perhaps, as well motivate a sedentary person starting any exercise program to improve physical fitness.[44]

Unlike our study, **Chen et al.(2012)**reported that the effect of maximal isometric contractions on maximal eccentric contraction-induced muscle damage is stronger than that of submaximal eccentric contractions, because the smaller number of isometric contractions (n =10) conferred a protective effect similar to that of a larger number of eccentric contractions (n = 30).[2]
Contrasting these studies, **Uchida et al.(2009)**demonstrated that both Creatin Kinase and DOMS had no significant differences in RBE, with an interval of two days between the first session and the second.[45]

In contrast to the previous results, **Howatson and Someren(2007)** reported that first session of eccentric exercise of the elbow flexors performed three days prior to second session of maximal eccentric exercise did not affect changes in indicators of muscle damage. ECC1and ECC2 resulted in significant reductions in maximal isometric force and ROM, and development of DOMS for all groups.[46]
These differences might be related to the large sample size in the current study wile small sample size in the previous study, also It might be that intensity of eccentric contractions in previous study was not enough to produce protection effect, also eccentric exercise may not be performed at long muscle length in previous studies, while in the current study the submaximal eccentric exercise at 85% of maximal power was used and subjects performed eccentric contractions at long muscle length from 90° elbow flexion to full elbow extension which produced more protection against muscle damage.
However this current study was repeated measures study design, the results of this study can conclude the repeated bout effect of submaximal eccentric contractions with 85% of maximal power and maximal isometric contractions at long muscle length performed two days prior to maximal eccentric exercise session were effective in prevention of DOMS, but submaximal eccentric contractions had the greatest effect in attenuation of maximal isometric peak torque loss, muscle pain and soreness immediately after and 48 hours after induction of DOMS.

## Clinical Implementations

**The findings of current study may be implemented in the following:**

1- Submaximal eccentric contractions could be used as prophylactic treatment to relieve DOMS for ordinary individuals.

2- Submaximal eccentric contractions could be used two days prior to unaccustomed physical activity to attenuate muscle soreness and enhance recovery of muscle function.

3- Maximal isometric contractions at long muscle length also could be used as prophylactic treatment to relieve DOMS with less muscle damage but it had less protection effect.

4- Submaximal eccentric contractions and maximal isometric contractions could be used in the rehabilitation program and in the phase of return to the work for ordinary individuals.

## Conclusion

**Within the scope of this study, the following conclusion was warranted:** Both submaximal intensity of eccentric contractions and maximal isometric contractions at long muscle length that performed two days prior to maximal eccentric protocol on isokinetic dynamometer were effective in prevention of induced delayed onset muscle soreness, but submaximal eccentric contractions had the greatest protection effect in attenuation of strength loss, muscle pain and soreness.

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## الملخص العربي

**المقارنة بين أقصى انقباض ساكن والانقباض الأستطالي الأقل من الأقصى فى الوقاية من الأحتقان العضلى المتأخر الخلفية:** الاحتقان العضلى المتأخر هو اكثر الأعراض شيوعا عندما يتعرض الأفراد الطبيعين والرياضين لنشاط بدنى غير معتاد وخصوصا **الأنقباض الأستطالي** مما يعوق الأداء الرياضى، قدرة العمل للأشخاص الطبيعين والوظائف البدنية. العديد من الطرق تم دراستها لتقليل الأحتقانالعضلى المتأخر، واحدة من الطرق القيمة للحد من **الاحتقان العضلى** المتأخر هى تأثير النوبة المتكررة كأسلوب وقائى. **الهدف:** يهدف هذا البحث إلى مقارنة تأثير النوبة المتكررةلأقصى انقباض ساكن فى مقابل الأنقباضالأستطالى الأقل من الأقصى على الاحتقان العضلي المتأخر المستحدث. **الطرق والأساليب:** أجريت هذه الدراسة على عينة مكونة من٦٠متطوعاً تراوحت أعمارهم فيما بين ٢٠-٣٠ سنةتم تقسيمهم عشوائياً إلى ٣ مجموعاتمتساوية. المجموعةالأولى ( أ ): المجموعة التجريبية الأولى و البالغ عددها ٢٠ فرد وقد تلقوا الأنقباضالأستطالى الأقل من الأقصى على الكوع الغير مهيمن كتمرين وقائى. المجموعة الثانية ( ب ): المجموعة التجريبية الثانية و البالغ عددها ٢٠ فرد وقد تلقوا أقصى انقباض ساكن على الكوع الغير مهيمن كتمرين وقائى.المجموعةالثالثة ( ج ): المجموعةالظابطة ولم تتلقى اى تمرين وقائى.وتم قياس قوة عزم الدوران لأقصى انقباض ساكن ومقياس تقييم كوع المريض ٣ مرات قبل، مباشرة بعد و ٤٨ ساعة بعد الأحتقانالعضلى المتأخر المستحدث.**النتائج:** و قد أسفرت النتائج عن وجود دلالة إحصائية لتأثير الانقباض الأستطالى الأقل من الأقصى فى المجموعة ( أ ) فى مقابل اقصى انقباض ساكن فى المجموعة (ب) فى الوقاية من الأحتقانالعضلى المتأخر المستحدث. **الخلاصة:** كل من الأنقباضالأستطالى الأقل من الأقصى و اقصى انقباض ساكن مؤثرين فى الوقاية من الأحتقانالعضلى المتأخر ولكن الأنقباضالأستطالى الأقل من الأقصى له تأثير الحماية الأكبر فى الوقاية من الأحتقانالعضلى المتأخر.



**الكلمات الدالة:الأحتقان العضلى** المتأخر-قوة عزم الدوران لأقصى انقباض ساكن -مقياس تقييم كوع المريض - تأثير النوبة المتكررة


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**Muscle Contribution to Supporting Phase During Normal Speed of Walking.**

**Salam Mohamed El Hafez, Ashour A. A. , Elhafez, N.M., Elhafez G.M.**

World Confederation for Physical Therapy, Singapore, UK, 1-4 May, 2015.

**Type of Participation:** Abstract.

**Abstract**

Backgrou The vertical ground reaction force (GRF) during normal gait is well known with its characteristic shape. The contribution of lower limb muscles to this vertical force was previously estimated but limited to using dynamic models and simulation. However, patients suffering from gait disturbances are referred by having muscle group dysfunctions. No previous studies investigated the contribution of muscle moments of the lower limb to the vertical GRF using 3D gait analysis system.

Purpc The purpose of this study is to investigate how the hip, knee and ankle moments in the sagittal plane contribute to the vertical GRF in normal subjects during normal speed of walking.

Methc Forty male subjects volunteered to participate in this study. They were filmed using six high speed (120 Hz) Pro-Reflex Infrared cameras (Qualisys) while walking on an AMTI force platform. Each lower limb joint position was detected using twenty reflective markers placed on the respective joint center of rotation according to the Pro-Reflex user manual. The data collected were the moments of the hip, knee and ankle joint in the sagittal plane at the instant of occurrence of the first peak and second peak and the trough of the vertical GRF. Relative contribution of each muscle moment to the vertical GRF was measured as the percentage relative to the maximum moment generated during stance.

Resu The results revealed that at the first peak of the GRF (at loading response), the highest contribution was generated from the knee extensor moment (80.2%), followed by hip extensor moment (36.81 %). The ankle plantar flexion moment produced least contribution to this peak (16%) relative to its maximum moment. Knee flexors and ankle plantar flexors moments produced high contribution to the trough of GRF (at midstance) with approximately equal values (53.88% and 54.1% respectively) while hip extensor moment contribution was less than both knee and ankle moments (34.75%). The second peak of the GRF was mainly produced by the ankle plantar flexors with highest percentage contribution of (99.1%), with lower contribution from knee flexors (41.44%) then hip flexors (36.9%). Hip and knee extensors contribution to this peak were 11.95% and 15.9% respectively.

Conclusion( Hip and knee flexors and extensors moments contributed to the three studied points of the GRF while the plantar flexors were the contributors to the trough and the second peak with a maximum percentage contribution at the second peak.

Implicatio Muscle contributions to the vertical ground-reaction force afford further insight into how support is generated in walking. As the classical shape of GRF reflects normal integrity of lower limb muscles, maintenance of the stance limb stability requires interplay of muscle activations with varying percentages. Weakness in one group is supposed to be compensated for by increasing or decreasing the activation of another group. In abnormal gait patterns, substituting weak muscle group with another normal muscle group can not only improve the global parameters of gait, but also to re-program the locomotor pattern to develop normal muscle moments without increasing joint loads or energy loss.

Key-Words: Muscle Contribution; Normal Gait; Ground Reaction Force

Funding acknowledgements: No Fund

Ethics approval: Ethical Committee of Faculty of Physical Therapy, Cairo University

**Preferred Presentation Type: Platform presentation**

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**Auxiliary Ultrasound and Laser Combined with Post- isometric Facilitation in Treatment of Shoulder Adhesive Capsulitis: A Randomized Clinical Trial.**

**Salam Mohamed El Hafez, Elhafez, H.M., Elhafez S.M.**

World Confederation for Physical Therapy, Singapore, UK, 1-4 May, 2015.

**Type of Participation:** Abstract.

**Abstract**

Background: Adhesive capsulitis (AC) is a common condition involving glenohumeral pain and loss of motion. Although AC is considered to resolve spontaneously within 1 or 2 years, patients will experience pain and/or residual disability several years after treatment. Adding new programs of treatment could enhance full recovery. No previous studies investigated the effect of electrotherpay applied at the axilla or the effect of Muscle Energy Technique (MET) on AC.

Purpose: The first purpose of this study is to introduce a new technique (axillary ultrasound, laser) combined with post-isometric facilitation in treating shoulder AC. The second purpose is to compare this new technique with standard care in the management of shoulder AC.

Methods: This is a randomized clinical trial study. Fifty nine participants with shoulder AC were selected and randomly assigned for eligibility. Forty five participants were assigned into three equal groups of fifteen. The participants were blinded to their group allocation. Standard care group (A) received traditional physical therapy treatment in the form of pulsed ultrasound, scanning laser, supervised exercise program and home exercise program; Group B received the same physical therapy program as Group A except that the ultrasound and scanning laser were applied to the axillary region of the painful shoulder (the new technique); Group C received the same modified physical therapy program as Group B plus postisometric facilitation technique to the painful shoulder. All dependent variables were measured by the second author, who was blinded to the participant´s intervention group. The first author administered treatment to all three groups. All participants received 12 sessions (3 times/week for 4 weeks). Pain level and shoulder range of motion (ROM) (flexion, abduction and external rotation) were recorded three times (pre-treatment, immediately post-treatment, and 4 weeks of treatment).

Results: Mixed design MANOVA indicated significant pain reduction with significant ROM increase in all groups post-treatment and after 4 weeks. Shoulder ROM and pain levels improved significantly post-treatment compared to pre-treatment ROM in all groups, with the greatest improvement in group C. Between groups analysis revealed that pain free shoulder flexion, abduction, external rotation and pain level improved significantly in group C compared to A and B immediately after treatment and after 4 weeks follow up ($P < 0.05$). Improvements reported in group B is more than A, and C is more than A and B.

Conclusion(s): Combining axillary ultrasound and laser with post-isometric facilitation had a greater (short term) effect in reducing pain and improving shoulder ROM in patients with shoulder AC.

Implications: Axillary application of ultrasound and laser could replace the traditional application (above the shoulder) for faster recovery of patients with shoulder AC. Adding post-isometric facilitation technique give better recovery.

Key-Words: Axillary ultrasound, laser; Adhesive capsulitis; post-isometric faciliitation

Funding acknowledgements: No fund

Ethics approval: The Research Ethics Committee (REC) of the Faculty of Physical Therapy, Cairo University, Egypt

**Preferred Presentation Type:** **Platform presentation**

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# Effect of Different Techniques of Non – Anatomical Repair of Anterior Shoulder Instability (Latarjet Procedures) on Patient's Response to Rehabilitation

**Khaled El Said Aiad, H. Ali, A. Rehan, W. Awadallah.**

World Confederation for Physical Therapy, Singapore, UK, 1−4 May, 2015.

**Type of Participation:** Search Study.

## Abstract

**Purpose :** The purpose of this study was to investigate effects of labrum preservation or removal on shoulder pain, mobility, strength and proprioception in patients with anterior shoulder instability repair.

**Backgrounds/Significance :** Anterior shoulder instability is a common traumatic injury that may be complicated with recurrent episodes of symptomatic instability. When instability is associated with soft tissue or bony defects, open repair is the preferred surgical intervention. Latarjet procedure is one of non-anatomical techniques used for such cases in which coracoid and its conjoined tendon is transferred to anterior glenoid. This compensates for the capsulolabral and osseous injury by an osseous or soft-tissue checkrein that blocks excessive translation and restores stability. This procedure could be done while preserving or removing the gelnoid labrum, depending on its integrity. Glenoid labrum increases glenohumeral joint congruency, stability and proprioception. Thus, its removal may affect joint integrity and hence patients' functional outcome. This in turn may influence the selection of rehabilitation protocols of those patients. To the authors' knowledge, there is no published evidence on changes in functional outcome in response to labrum removal or preservation.

**Subjects :** Twenty eight patients with age ranged between 22 and 52 years old were enrolled in this study. All patients have undergone Latarjet procedure for correction of recurrent shoulder instability and were referred for rehabilitation 2 weeks post-operatively. Patients were excluded if they showed any postoperative signs of recurrent instability, had any systematic or neurological disease that could interfere with shoulder function, or received previous corticosteroid injections into the operated shoulder. Based on the surgical technique, patients were divided into labrum preserved group (n=14), and labrum removed group (n=14).

**Methods and Materials :** After initial baseline assessment and examination, all patients received a standardized physical therapy rehabilitation protocol that was designed by Brigham and Women's Hospital, U.S.A.[1] Briefly, this program consists of range of motion, open and closed kinetic chain exercises. Patients were treated during the immediate post-surgical phase that focuses on pain relief and enhancing the healing process; and the intermediate phase that primarily targets the restoration of shoulder motions; and the muscle strengthening phase.

Pain severity, shoulder range of motion and muscle strength was quantified using the shoulder pain score, a digital inclinometer and a hand-held muscle tester, respectively. Proprioception acuity was measured using the closed kinetic chain upper extremity stability test (CKCUET). All measurements were done at $2^{nd}$ (during phase I) and $16^{th}$ weeks (at the end of Phase III).

**Analyses :** Repeated measures ANOVA using SPSS version 21.0. Significance level was set at $p<0.05$ throughout all analyses. Data are presented as means and SD.

**Results :** Within group comparisons showed significant improvement in all measured variables between the $2^{nd}$ and $16^{th}$ weeks in patients of two groups ($p<0.01$).

Between groups comparison showed significant improvement in patients with labrum preservation regarding proprioception acuity ($p<0.011$, figure 01). Patient with labrum removal showed significantly greater improvement in pain severity ($p<0.001$, figure 02) and external rotation range of motion ($p<0.001$, figure 03).

**Conclusion :** Labrum preservation improves shoulder proprioception. On the other hand, labrum removal, when indicated, significantly improves pain and external rotation range following latarjet operation. Biomechanical and neurophysiological analysis as well as long term follow up is recommended to explain reported results.

**References**

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**Pairwise Comparisons**

| Measure | Group | (I) time | (J) time | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower Bound | Upper Bound |
| flexion | Preservation | 1 | 2 | -3.850-* | .333 | .000 | -4.535- | -3.165- |
| | | 2 | 1 | 3.850* | .333 | .000 | 3.165 | 4.535 |
| | Removal | 1 | 2 | -3.107-* | .333 | .000 | -3.792- | -2.422- |
| | | 2 | 1 | 3.107* | .333 | .000 | 2.422 | 3.792 |
| Abduction | Preservation | 1 | 2 | -4.086-* | .236 | .000 | -4.571- | -3.601- |
| | | 2 | 1 | 4.086* | .236 | .000 | 3.601 | 4.571 |
| | Removal | 1 | 2 | -3.357-* | .236 | .000 | -3.842- | -2.872- |
| | | 2 | 1 | 3.357* | .236 | .000 | 2.872 | 3.842 |
| Ext_rot | Preservation | 1 | 2 | -3.986-* | .267 | .000 | -4.535- | -3.437- |
| | | 2 | 1 | 3.986* | .267 | .000 | 3.437 | 4.535 |
| | Removal | 1 | 2 | -2.564-* | .267 | .000 | -3.113- | -2.015- |
| | | 2 | 1 | 2.564* | .267 | .000 | 2.015 | 3.113 |
| Int_rot | Preservation | 1 | 2 | -3.957-* | .369 | .000 | -4.715- | -3.199- |
| | | 2 | 1 | 3.957* | .369 | .000 | 3.199 | 4.715 |
| | Removal | 1 | 2 | -3.336-* | .369 | .000 | -4.094- | -2.578- |
| | | 2 | 1 | 3.336* | .369 | .000 | 2.578 | 4.094 |
| CKCUT | Preservation | 1 | 2 | -8.429-* | .570 | .000 | -9.601- | -7.256- |
| | | 2 | 1 | 8.429* | .570 | .000 | 7.256 | 9.601 |
| | Removal | 1 | 2 | -5.929-* | .570 | .000 | -7.101- | -4.756- |
| | | 2 | 1 | 5.929* | .570 | .000 | 4.756 | 7.101 |
| Pain | Preservation | 1 | 2 | 4.732* | .344 | .000 | 4.025 | 5.439 |
| | | 2 | 1 | -4.732-* | .344 | .000 | -5.439- | -4.025- |
| | Removal | 1 | 2 | 5.714* | .344 | .000 | 5.007 | 6.421 |
| | | 2 | 1 | -5.714-* | .344 | .000 | -6.421- | -5.007- |
| St_flexion | Preservation | 1 | 2 | -15.000-* | 1.520 | .000 | -18.124- | -11.876- |
| | | 2 | 1 | 15.000* | 1.520 | .000 | 11.876 | 18.124 |
| | Removal | 1 | 2 | -21.929-* | 1.520 | .000 | -25.053- | -18.804- |
| | | 2 | 1 | 21.929* | 1.520 | .000 | 18.804 | 25.053 |
| St_Abd | Preservation | 1 | 2 | -18.071-* | 2.000 | .000 | -22.181- | -13.961- |
| | | 2 | 1 | 18.071* | 2.000 | .000 | 13.961 | 22.181 |
| | Removal | 1 | 2 | -22.786-* | 2.000 | .000 | -26.896- | -18.676- |
| | | 2 | 1 | 22.786* | 2.000 | .000 | 18.676 | 26.896 |
| St_ext_rot | Preservation | 1 | 2 | -16.357-* | 1.611 | .000 | -19.669- | -13.045- |
| | | 2 | 1 | 16.357* | 1.611 | .000 | 13.045 | 19.669 |
| | Removal | 1 | 2 | -21.857-* | 1.611 | .000 | -25.169- | -18.545- |
| | | 2 | 1 | 21.857* | 1.611 | .000 | 18.545 | 25.169 |
| St_int_rot | Preservation | 1 | 2 | -19.571-* | 1.561 | .000 | -22.780- | -16.362- |
| | | 2 | 1 | 19.571* | 1.561 | .000 | 16.362 | 22.780 |
| | Removal | 1 | 2 | -17.143-* | 1.561 | .000 | -20.352- | -13.934- |
| | | 2 | 1 | 17.143* | 1.561 | .000 | 13.934 | 20.352 |

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

**Univariate Tests**

| Measure | time | | Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared | Noncent. Parameter | Observed Power[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| flexion | 1 | Contrast | 90.720 | 1 | 90.720 | 4.564 | .042 | .149 | 4.564 | .539 |
| | | Error | 516.777 | 26 | 19.876 | | | | | |
| | 2 | Contrast | 132.023 | 1 | 132.023 | 5.119 | .032 | .164 | 5.119 | .586 |
| | | Error | 670.616 | 26 | 25.793 | | | | | |
| Abduction | 1 | Contrast | 75.900 | 1 | 75.900 | 5.185 | .031 | .166 | 5.185 | .592 |
| | | Error | 380.626 | 26 | 14.639 | | | | | |
| | 2 | Contrast | 113.203 | 1 | 113.203 | 6.583 | .016 | .202 | 6.583 | .695 |
| | | Error | 447.084 | 26 | 17.196 | | | | | |
| Ext_rot | 1 | Contrast | 1.373 | 1 | 1.373 | .153 | .699 | .006 | .153 | .066 |
| | | Error | 233.264 | 26 | 8.972 | | | | | |
| | 2 | Contrast | 6.703 | 1 | 6.703 | .634 | .433 | .024 | .634 | .120 |
| | | Error | 274.786 | 26 | 10.569 | | | | | |
| Int_rot | 1 | Contrast | 5.058 | 1 | 5.058 | .565 | .459 | .021 | .565 | .112 |
| | | Error | 232.849 | 26 | 8.956 | | | | | |
| | 2 | Contrast | 15.156 | 1 | 15.156 | 1.532 | .227 | .056 | 1.532 | .222 |
| | | Error | 257.129 | 26 | 9.890 | | | | | |
| CKCUT | 1 | Contrast | .321 | 1 | .321 | .092 | .764 | .004 | .092 | .060 |
| | | Error | 90.643 | 26 | 3.486 | | | | | |
| | 2 | Contrast | 36.571 | 1 | 36.571 | 7.598 | .011 | .226 | 7.598 | .756 |
| | | Error | 125.143 | 26 | 4.813 | | | | | |
| Pain | 1 | Contrast | .321 | 1 | .321 | .181 | .674 | .007 | .181 | .069 |
| | | Error | 46.286 | 26 | 1.780 | | | | | |
| | 2 | Contrast | 10.020 | 1 | 10.020 | 13.998 | .001 | .350 | 13.998 | .949 |
| | | Error | 18.612 | 26 | .716 | | | | | |
| St_flexion | 1 | Contrast | 28.000 | 1 | 28.000 | .752 | .394 | .028 | .752 | .133 |
| | | Error | 967.857 | 26 | 37.225 | | | | | |
| | 2 | Contrast | 170.036 | 1 | 170.036 | 4.690 | .040 | .153 | 4.690 | .550 |
| | | Error | 942.643 | 26 | 36.255 | | | | | |
| St_Abd | 1 | Contrast | .893 | 1 | .893 | .025 | .874 | .001 | .025 | .053 |
| | | Error | 912.071 | 26 | 35.080 | | | | | |
| | 2 | Contrast | 132.893 | 1 | 132.893 | 2.914 | .100 | .101 | 2.914 | .376 |
| | | Error | 1185.786 | 26 | 45.607 | | | | | |
| St_ext_rot | 1 | Contrast | 43.750 | 1 | 43.750 | 1.188 | .286 | .044 | 1.188 | .183 |
| | | Error | 957.214 | 26 | 36.816 | | | | | |
| | 2 | Contrast | 448.000 | 1 | 448.000 | 16.455 | .000 | .388 | 16.455 | .974 |
| | | Error | 707.857 | 26 | 27.225 | | | | | |
| St_int_rot | 1 | Contrast | 137.286 | 1 | 137.286 | 4.005 | .056 | .133 | 4.005 | .487 |
| | | Error | 891.143 | 26 | 34.275 | | | | | |
| | 2 | Contrast | 28.000 | 1 | 28.000 | 1.368 | .253 | .050 | 1.368 | .203 |
| | | Error | 532.000 | 26 | 20.462 | | | | | |

Each F tests the simple effects of Group within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

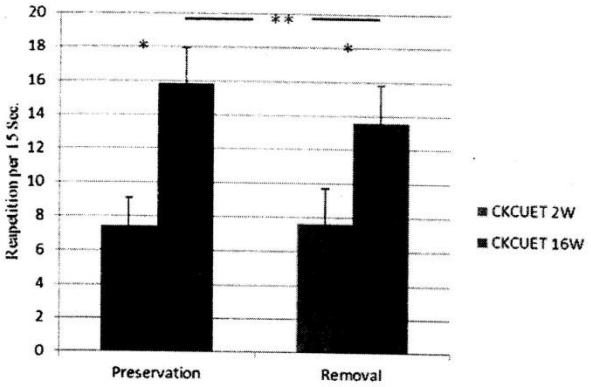


Fig. (01) Closed Kinetic Chain Upper Extremity Test

* Indicate within group significance

** Indicate between group significance

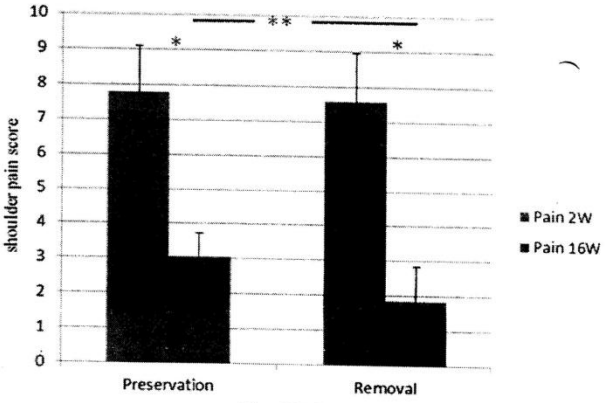


Fig. (02): Pain

* Indicate within group significance

** Indicate between group significance

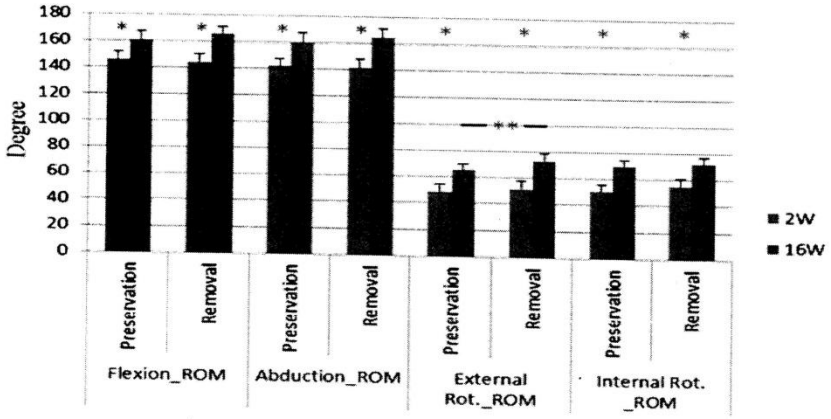


Fig. (03) Range of Motion

*Indicate within group significance

** Indicate between group significance

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