Scientific studies which produced by education members faculty and assistant staff during attending scientific conferences abroad 2013-2016

Scientific Conferences 2016

Active Release Technique versus Muscle Energy Technique on Hamstring Flexibility in Normal Adults

Mohamed Marzok Mohamed Ragb

Asian Confederation of Physical Therapy 2016 Congress (ACPT 2016 Congress) ,Malaysia, October 7-8 2016.

Type of Participation: Excellence in Research and Innovation for Humanity and **Research pdf.**

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Can Clinical Outcome Measures Predict Cobb's Angle in Patients with Idiopathic Scoliosis?

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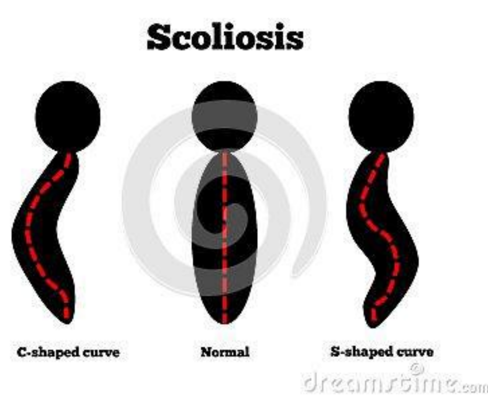
17th EFFORT Congress ,Switzerland, June 1-3 2016.

Type of Participation: Search Study and Poster.

INTRODUCTION



Idiopathic scoliosis is a common deformity that is associated with high morbidity rates. Neglect or improper treatment eventually leads to progression of the deformity, and subsequently, may distress patients and affect the quality of their lives.
Clinical outcome measures are popular tools to quantify the quality of life of patients which is affected clearly in patients with Idiopathic scoliosis can vary between back pain ,decreased pulmonary function, poor aerobic capacity, physical inactivity and limitations in the patients' functional and vocational life ; especially with severe deformity. Also a weak self image, affection of mental health, depression and a poor social life that is more evident in female patients and those treated with braces or corrective surgery.

There is a contradiction whether radiographic findings and clinical outcome measures are associated. Furthermore, it is not clear how much could clinical outcome measures predict radiographic findings, specifically cobb's angle that represent the severity of scoliosis.

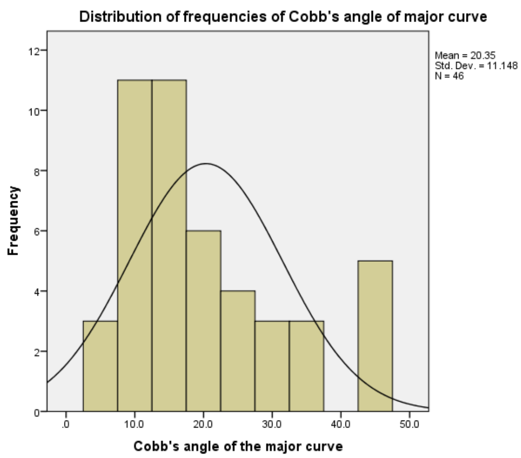
The purpose of this study was to assess whether clinical outcome measures, specifically, the Scoliosis Research Society-22 (SRS-22) questionnaire, could predict the Cobb's angle in Egyptian patients with idiopathic scoliosis.

MATERIALSAND METHODS

Forty six patients with idiopathic scoliosis (40 females, 6 males) were enrolled in this study. Participants mean age was 22±3.14 years and mean Cobb's angle was $20^0 \pm 11^0$ (range 5^0-44^0). Twenty-three patients were on active physiotherapy treatment, 5 were treated by bracing, 2 underwent surgery and the remaining received a wait-and see treatment approach.

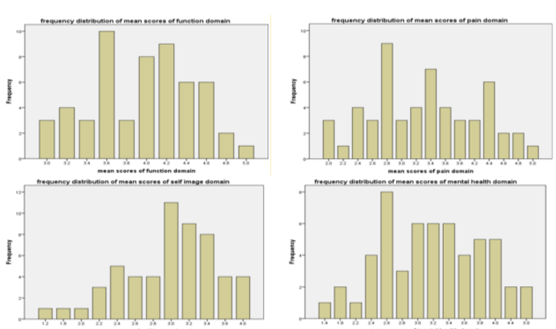
Patients were asked to fill in an Arabic cross-culture translated form of (SRS-22). This is a valid and reliable clinical outcome measure to assess the quality of life inpatients with idiopathic scoliosis. The questionnaire administered consists of five sub-domains inquiring about function, pain, self-image, and mental health, and satisfaction with management.

The mean scores for the first four sub-domains were calculated and used for further statistical analysis. Regression model analysis using the step wise method was used to assess the predictability of Cobb's angle by the SRS-22 sub-domains scores.



RESULTS

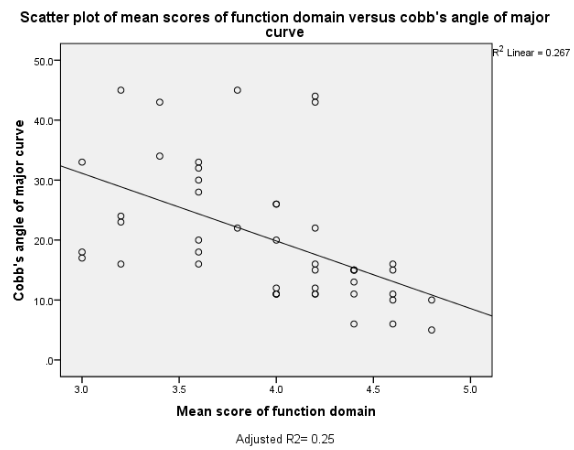
The mean scores of the function, pain, self-image and mental health domains provided a wide spectrum of score distributions.



Among the four domains tested, only function domain significantly predicted the Cobb's angle (p<0.001) and explained 25% of the variability seen (adjusted R2=0.25).

The results showed an inverse correlation between the mean functions core and the Cobb's angle. This implies that greater Cobb's angle was associated with less functional scores. Based on the current results

Cobb's angle regression equation is(Cobb's angle = 64.95–11.27×mean function score).



DISCUSSION AND CONCLUSION

According to the data in this study, there was no association between pain, self-image, mental health domains and the degree of severity of curve measured by cobb's angle.

This may be attributed to the patient's perception of what constitutes the quality of lifestyle affection and that is more dependent on variables such as personality, environment, educational and professional abilities, and individual expectations on treatment results.

The correlation between function domain and the severity of curve signifies that function domain of SRS-22 is a significant predictor that can explain 25% of the variability seen in Cobb's angle of patients with idiopathic scoliosis.

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Effect of Manual Ischemic Progressive Pressure versus Post Isometric Facilitation in Treatment of Latent Myofascial Trigger Point in Mechanical Neck Pain

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Type of Participation: Poster presentation.

Abstract

BACKGROUND: Myofascial pain syndrome a common type of associated with regional pain and muscle tenderness characterized by the presence of hypersensitive nodules**. OBJECTIVES:** the purpose of this study is to compare between the effects of manual progressive ischemic pressure versus the effect of post isometric facilitation in the treatment of Rhomboid latentmyofascial trigger points. **METHODS:** six patients had participated in this study. Patients divided into two groups .Group A treated by manual progressive ischemic pressure and traditional physical therapy program .Group B treated by post isometric facilitation and traditional nonarticular musculoskeletal pain, is a condition physical therapy program. treatment program for 6 session over two weeks period. **RESULT**: Statistical analysis revealed that there is no significant difference in post treatment from pre treatment in pain severity (VAS) in myofascial trigger points with Rhomboid muscles) and Pain pressure threshold (PPT) for tenderness at both groups (A,B). **CONCLUSION**: ischemic pressure technique appear to be no more effective than post isometric facilitation in treatment of rhomboids latent myofacial trigger point

Key Words:

Rhmoiboid trigger point, myofacila trigger point ,ischemic pressure, post isometric facilitation .

Urodynamic effect of percutaneous posterior tibial nerve stimulation for urinary incontinence in paraparetic patients

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6th International Conference on Physiotherapy in Psychiatry and Mental Health, Madrid Spain, March 9-11 2016.
Type of Participation: Search Study.

Abstract

The **purpose** of this study is to evaluate the effectiveness of Percutaneous Posterior Tibial Nerve Stimulation (PPTNS)in treatment of Urinary Incontinence in Paraparetic Patients.Dorsal level from T_7 to T_{12}.**Thirty** traumatic Paraparetic patients of both sexes were selected for this study. Their age ranged from 25-40 years, their weight ranged from 60 to 88kg and their height ranged from 155-180. They were randomly divided into two equal groups; **GI** is a control group was treated by physical therapy program for bladder training and placebo PPTNS,**GII** is an experimental group was treated by the same physical therapy program in addition to PPTNS. All subjects received the **treatment** program for 40 minutes, three days per week day after dayfor 12weeks.Allpatients were **assessed** by Modified Ashworth Scale for muscle tone grade3, biofeedback for pelvic floor muscle, Electromyography for detrusor and pelvic floor muscles, urine testing and bladder residual volume measured bycystometry, testing in all patients were done before initiating conservative treatment and after the end of treatment program.Electrical stimulation was applied toposterior tibial nerve stimulation. **The results** showed that, there was astatistically significant improvement in GII than GI, regarding all variables (P<0.001). **Conclusion:** PPTNS is an effective method in treating urinary incontinence in Paraparetic patients and consider as a treatment modality filling the gap between conservative and surgical therapies in patients with certain types of urinary incontinence.

Key words:

Percutaneous Posterior Tibial Nerve Stimulation, Cystometry, Biofeedback, Electromyography, Urinary Incontinence, and Paraparesis.

Introduction

Paraparesis refers to partial loss of voluntary motor function in the pelvic limbs. Paraparesis generally results from spinal cord lesions caudal to the second thoracic spinal cord segment. Trauma and neoplasia are the most common spinal cord diseases. Urinary and fecal incontinence often occur concomitant with paresis,general concepts relating to disorders of micturition[1].

After spinal cord injury the bladder, along with the rest of the body, undergoes dramatic changes. Since messages between the bladder and the brain cannot travel up and down the spinal cord, the voiding pattern described above is not possible. Depending on the type of spinal cord injury, your bladder may become either "floppy" (flaccid) or "hyperactive" (spastic or reflex) [2].

The detrusor muscles in a hyperactive bladder may have increased tone, and may contract automatically, causing incontinence (accidental voiding). Sometimes the bladder sphincters do not coordinate properly with the detrusor muscles, and medication or surgery may be helpful. Also, the bladder cannot be able to empty when it becomes full. The problem is that person cannot feel or control this reflex, so either leak urine or urinate involuntarily (urinary incontinence), this one typically occurs when the SCI is above the T12 level[3].

With a flaccid or non-reflex bladder, the reflex that triggers the bladder to empty is either non-existent or sluggish at best. When this happens, the bladder may become so distended that urine backs up into the kidneys, which can cause a kidney infection or the bladder may not empty completely and retain urine, this type usually occurs when the SCI is at or below the T12-L1 level[4].

Incontinence has several subtypes: stress incontinence, mixed urinary incontinence, overflow incontinence, and transient incontinence[5]. Transient incontinence may be related to delirium, infection, atrophy, pharmaceuticals, psychologic factors, excess urine output, restricted mobility, or stool impaction[6]. More than 40% of people with overactive bladder have incontinence[7].While about 40% to 70% of incontinence is due to overactive bladder[8], it is not life-threatening. Most people with the condition have problems for years.

Individual with SCI and associated bladder problems will need a urinary catheter to manage their bladder problems[9]. Someone who has a spastic bladder may use a single-use, intermittent catheter or indwelling (Foley) catheter[10]. Males may choose to use an external condom catheter instead.Those with a flaccid bladder typically self-cath with intermittent catheters[11].Complications of bladder problems resulting from SCI include urinary tract infections, sepsis, dyssynergia, kidney stones or bladder stones and bladder cancer in those who use indwelling catheters for a long period of time[12].

Fortunately, treatment of urinary incontinence decreases the incidence of urinary tract infections and skin irritation and infection. Recently, intermittent percutaneous posterior tibial nerve stimulation was introduced as a treatment modality filling the gap between conservative and surgical therapies in patients with certain types of lower urinary tract dysfunction[13].

The pelvic floor consists of the bony pelvis, endopelvic fascia, and muscle. From a urodynamic perspective, the pelvic floor muscles contribute directly to continence by assisting with urethral closure during bladder storage, and indirectly by providing support for the lower urinary tract and adjacent organs, including the rectum and the uterus and vagina in women[27]. The primary pelvic floor muscle is the levatorani, which is sometimes subdivided into the pubococcygeus and ileococcygeus. Other pelvic floor muscles include the urethrovaginal sphincter, compressor urethrae muscle, ischiocavernosus, and bulbospongiosus[15].

The pelvic floor muscles serve as a dynamic backboard that along with passive support from the bony pelvis and endopelvic fascia, maintain the pelvic organs in their abdominopelvic positions. The pelvic floor muscles also contribute to continence by enhancing urethral closure via rapid contraction during coughing, sneezing, or physical activity. Nevertheless, the rhabdosphincter muscle is primarily responsible for urethral closure during bladder filling and storage[16].

Because of pelvic floor muscles contribution to continence, the measurement of pelvic floor muscle function is considered an integral component of a comprehensive urodynamics evaluation, especially when neurologic, gynecologic, or trauma-related factors impair lower urinary tract function, standard urodynamics testing uses EMG to evaluate pelvic floor muscle activity[17].

Biofeedback is a technique developed over the last three decades which is indicated to teach subjects to bring certain physiologic processes under voluntary control. Application of this technique primarily directed toward disorders that were thought to include a component of stress, psychosomatic or psycho physiologic features[18].

Many patients have difficulty identifying, controlling and co-coordinating the function of pelvic floor muscle group, when verbally instructed in pelvic floor exercises, patients may perform them ineffectively, with biofeedback these exercises are performed with simultaneous electromyographic feedback given to the patients to help facilitate awareness of the state of muscle contraction, therapy uses an electronic or mechanical devices to relay visual or auditory evidence of pelvic floor muscle tone to improve awareness of pelvic floor musculature to assist patients in the performance of pelvic floor muscle exercises. Biofeedback has proven helpful in addressing many conditions, among them high blood pressure, depression, headaches, chronic pain, and urinary incontinence[19].

Material and Methods

Subjects

ThirtyParaparetic patients of both sexes were selected for this study from the outpatient department Urology, Neurology and Neurological Rehabilitation, Armed Force hospital, Najran. Patients age ranged from 25-40 years, with a mean value of 35.2(±1.1) years, their weight ranged from 60 to 88kg, with a mean value of 75.4(±1.4) kg and their height ranged from 155-180cm, with a mean value of 164.6(±7.1) cm, the patients were randomly and equally divided into two groups .**Group (1)** : was a control group and consists of 15 patients of both sexes, was treated by physical therapy program for bladder training (strengthening exercises for abdominal and pelvic floor muscles, tapping, percussion pressure and scratching and brief icing on lower abdomen) and placebo PPTNS and **GII** is an experimental group was treated by the same physical therapy program in addition to PPTNS. All subjects received the treatment program for 30 minutes, three days per week day after day, for 12weeks.Allpatients were **assessed** by Modified Ashworth Scale for muscle tone grade3.Basic assessment includes investigations such as biofeedback for pelvic floor muscle, Electromyography for detrusor and pelvic floor muscles, urine testing by cystometry and bladder residual volume measurement, testing in all patients were done before initiating conservative treatment and after the end of treatment program.Electrical stimulation was applied from the medial malleolus and posterior to the edge of the tibia by using 200 microsecond pulses with a pulse rate of 20 Hz for 30 minutes.**Inclusion criteria**: Thirty Parapareticpatients of both sexes.All patients were medically stable by measuring vital signs which include (blood pressure, temperature, pulse rate and respiratory rate) .All patients were conscious, co-operative, medically, neurologically and psychologically normal, had no disability secondary to orthopedic problems or surgery.All patients had no impairment of general or special senses.**Exclusion criteria:**The exclusion criteria were detrusor sphincter dyssynergia, sacral peripheral nerve lesions, urinary tract infection, serious secondary disease, marked prostatic enlargement on digital rectal examination, bladder stones, pregnancy, diabetes mellitus, and severe cardiopulmonary disease. Patients with a history of previous continence surgery, current bladder malignancy, high-grade dysplasia, or carcinoma,severe degree of disabilities, patients having complications, psychological unstable , non co-operative patients during assessment of the research were excluded from the study.

Evaluation Procedures: A- EMG Neuropac.. B-Cystometry (MMS Solar Digital Urodynamic Device, Dover, N.H).C-Biofeedback.C- Lafayette tensiometer.

Electromyography (EMG) Unit: It contains of EMG apparatus, Disposable surface EMG electrodes and Data processing computer unit. The neuro pack S1 MEC-9400K, 4 channel EMG/EP system, disposable and radiolucent electrodes.**Electrodes:**The electrodes were self adhesive with active surface area of 1cm^2 in diameter. The electrodes consist of plastic foam material with a silver plate disc on one side and silver plate snap in the center on the other side. Early released protective sheet is placed over the electrode side to keep the electrolyte part of the disc in its position. The electrodes were connected to EMG apparatus channel.Evaluation procedures: Patient's preparation before putting EMG electrodes over the skin for each patient, it should be shaving the hair at the picking areas and cleaning it by alcohol to remove the dead layers of the skin in site of EMG electrodes (detrusor and pelvic floor muscles). Electrodiagnostic Test: Technical steps of application EMG including; electrode placement, skin temperature correction, determination of nerve stimulation intensity and analysis of the evoked neuro- electrical response. The system comprises an electronic monitor and a report generation system. The registry stores all electrophysiological data including raw wave forms and limited demographic information (age, height, weight and gender).

Pelvic floor muscle: Pelvic floor muscle EMG may also be measured by surface electrodes. The ideal surface patch for urodynamics testing will adhere to the anal mucosa, adapt well to the complex skin and mucosal surfaces of the anus.

Urodynamic Measurements(Incontinence testing):Cystometry: was performed with the patient in the supine position (MMS Solar Digital Urodynamic Device, Dover, N.H.). Intravesical and abdominal pressures were measured with double lumen 8F air-charged catheters with a rectal balloon (T-DOC Company, Wilmington, Del). Cystometry was performed with normal saline solution at room temperature. The filling rate was 50 mL/min. Volume at the first involuntary detrusor contraction and volume at maximum cystometric capacity (MCC) were noted. Second cystometry was performed immediately after posterior tibial nerve stimulation at a 50-mL/min filling rate. The detrusor pressure was calculated as the difference between the intravesical and abdominal pressure. A comparison was performed between volume at the first involuntary detrusor contraction and at MCC for standard Cystometry and for Cystometry during PTNS. MCC was defined previously for the patient with urge urinary incontinence[13]. Also, in our study the patient was taken to a point where he/she would leak urine, and volume infusion was not stopped when the patient was anxious.Routine Cystometry at 50 ml. per minute was done to select the patients with involuntary detrusor contractions appearing before 400 ml. maximum filling volume. Repeat Cystometry was performed immediately after the posterior tibial nerve stimulation. Volume comparison was done at the first involuntary detrusor contraction and at maximum cystometric capacity. The test was considered positive if volume at the first involuntary detrusor contraction and/or at maximum cystometric capacity increased 100 ml. or 50% during stimulation in compared with standard volumes.

Post-void residual volume: This test measures the amount of urine left after you empty your bladder.

Biofeedback: It is a teaching tool to help, learn, control and strengthen the pelvic floor area, soused to treat incontinence by helping and learning to control and strengthen pelvic floor muscles, which play a crucial role in bladder control. Incontinence can occur if those muscles are too weak to properly control bladder function or are not responding properly. The therapy begins by applying electrodes to the body, small sensors are placed near the anus, where the pelvic floor muscles are closest to the skin. Patients then begin performing a series of pelvic floor exercises designed to strengthen those muscles. The sensors provide feedback on a computer screen or through audio tones that tell you whether the patients are contracting the correct muscles.

Biofeedback sessions that address urinary incontinence generally last about half an hour.

Treatment Procedures:

Electrical stimulation of the posterior tibial nerve is in aid of electrodes in the region of the posterior tibial nerve, this form of electrical stimulation inhibits bladder activity by depolarization of somatic afferent fibers and lumbar sacral, resulting in motor and sensory responses to stimulation of the posterior tibial nerve area. The technique consists of stimulating the nerve by surface electrode 4–5 cm cephalad to the medial malleolus. Once the current is applied, the flexion of the big toe or the movement of the other toes confirms the correct positioning of the electrode. The electric current is a continuous, square wave form with a duration of 200µs and a frequency of 20 Hz for 30 minutes. The current intensity is determined by the highest level tolerated by the patient. The stimulation sessions last for 30 minutes and are performed day after day in a week for 12 weeks.

The **Pelvic Floor Exercises** have as principle the repetitive voluntary contractions of the pelvic floor, increasing muscle strength and hence urinary continence by stimulating the activity of the urethral sphincter. The exercises are effective for urge incontinence because they reinforce the reflex contraction of the pelvic floor, causing inhibition of detrusor contraction.Pelvic floor exercises: Kegel exercises help to strengthen the pelvic floor, keep pelvic muscles, tissues strong which can prevent stress incontinence, can be done anytime as follow: a) Pretend you are trying to stop the flow of urine. B) Hold the squeeze for 10 seconds, c) then rest for 10 seconds. Do 3 or 4 sets daily. Timed voiding and bladder training. First, you complete a chart of the times you urinate and the times you leak. You observe patterns and then plan to empty your bladder before an accident would likely occur. You can also "retrain" your bladder, gradually increasing the time between bathroom visits. Kegel exercises are also helpful. It aims to increase the storage capacity of the bladder.

Voiding Exercises: is encouraged in one of several ways, such as:AnalorRectal Stretch for relaxing the urinary sphincter is usually used along with an abdominal corset. Crede method involves manually pressing down on the bladder. Tapping area over the bladder is tapped with the fingertips or the side of the hand, lightly and repeatedly, to stimulate detrusor muscle contractions and voiding. Valsalva method involves increasing pressure inside the abdomen by bearing down as if you were going to have a bowel movement. Voiding Diary in the patient performs a self-monitoring data for at least 24 hours (can be made up to 3 days), recording the following information: time, volume and frequency of urination, incontinence episodes, frequency of use of absorbent (day, time and night), water intake and intestinal habits.

Statistical analysis: The results of two groups were statistically analyzed by t-test to compare the differences within each group and between the two groups. The statistical package of social science (SPSS version 10) was used for data processing the P-value 0.05 level significance.

Data Summarized by using: The arithmetic mean average describing the central tendency of observation where The standard deviation (S.D) used to measure to described the results around mean where paired and unpaired t-test was performed to determine the significance difference pre and post within the same group and the differences between the two groups.

RESULTS

Thirty males and females subjects participated in the study, their ages ranged between (25–40) years with mean age (35.2±0.1) years, their weights ranged between (60–88) kg with mean weight (75±1.4) kg. The subjects were divided into two equal groups. Each group consisted of fifteen subjects. The characteristics of subjects in each group are shown in Table1 and Fig1.

Table1: Characteristics of age and weight in both groups.

	Group 1		Group 2		T	P	Sig.
	Mean	S.D	Mean	S.D			
Age (yrs)	35.2	±6.3	35.2	±6.3	0.45	0.81	NS
Weight (Kg)	75.3	±6.8	74.8	±8.7	0.67	0.87	NS

The independent t test between the two groups showed no significant differences between groups of age (Where P value was 0.81) and weight (where P value was 0.87), as shown in Table1andFig1.

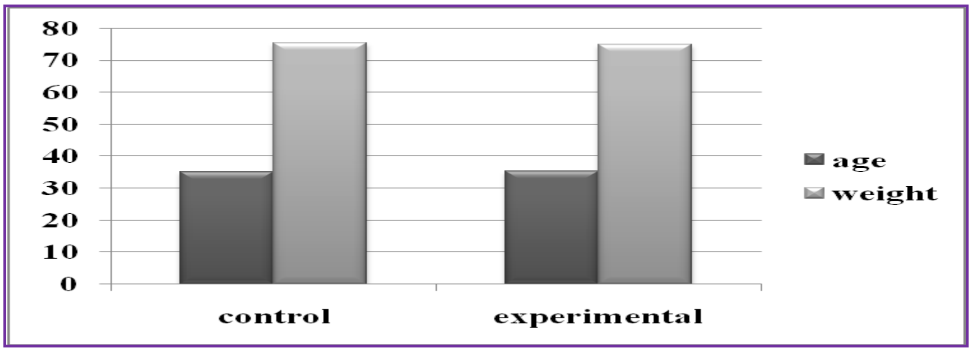

Figure (1): Characteristics of age and weight in both groups

Differences in EMG amplitude of detrusor muscle between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in EMG amplitude for detrusor musclebefore the experimental trial where the t value was -0.374 , while P was 0.711, and moderate significant differences when measured post experimental trial where the t value was -15.19, while P was 0.002 as shown in Table 2 and Fig2.

Table2:T-test between the two groups of EMG amplitude ofdetrusor muscle before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	0.6	±0.1	-0.374	0.711
	GII	0.6	±0.1		
Post-test	G I	0.9	±0.1	-15.19	0.002
	GII	1.5	±0.1		

Differences in EMG amplitude of detrusor muscle within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in EMG amplitude of detrusor muscle where the t value was -15.9 while P was 0.01 and moderate significant differences between pre and post test of group II where the t value was -29.79, while P was 0.001 as shown in Table 3 and Fig2.

Table3: T-test within the two groups of EMG amplitude of Pelvic floor muscles before and after the experimental trial.

		Mean	SD	T	P
Group I	Pre	0.6	±0.1	-13.26	0.01*
	Post	0.9	±0.1		
Group II	Pre	0.6	±0.1	-20.58	0.001**
	Post	1.1	±0.1		

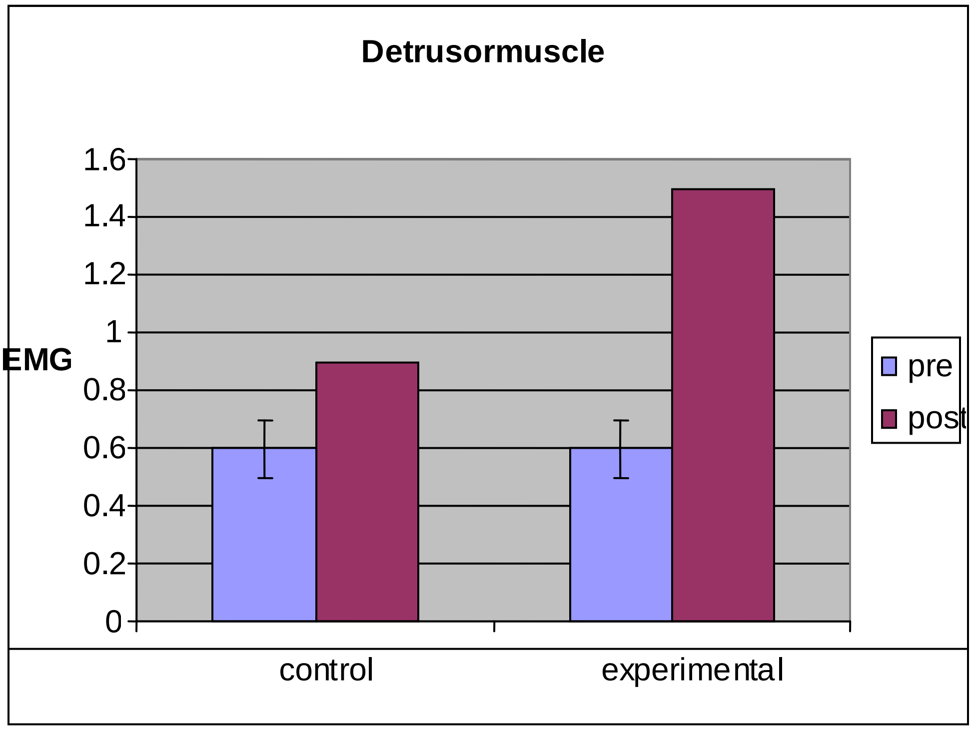

Fig2: Showing the results of EMG amplitude of detrusor muscle time in each group.

Differences in EMG amplitude of Pelvic floor muscle between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in EMG amplitude for Pelvic floor muscle measured before the experimental trial where the t value was -0.132, while P was 0.896 and moderate significant differences when measured post experimental trial where the t value was -2.93, while P was 0.007 as shown in Table 4 and Fig3.

Table4: Results of the t-test between the two groups of EMG amplitude of Pelvic floor muscle measured before and after the experimental trial.

		Mean	SD	T	P
Pre- test	**G I**	0.6	±0.1	-0.132	0.896
	GII	0.6	±0.1		
Post- test	**G I**	0.9	±0.1	-2.93	0.007**
	GII	1.1	±0.1		

Differences in EMG of Pelvic floor muscle within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in EMG amplitude for Pelvic floor muscle where the t value was -13.26 while P was 0.01 and moderate significant differences between pre and post test of group II where the t value was -20.58, while P was 0.001 as shown in Table 5 and Fig3.

Table5: T-test within the two groups of EMG amplitude of Pelvic floor muscles before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	0.6	±0.1	**-13.26**	**0.01***
	Post	0.9	±0.1		
Group II	**Pre**	0.6	±0.1	**-20.58**	**0.001****
	Post	1.1	±0.1		

Pelvic floor muscle

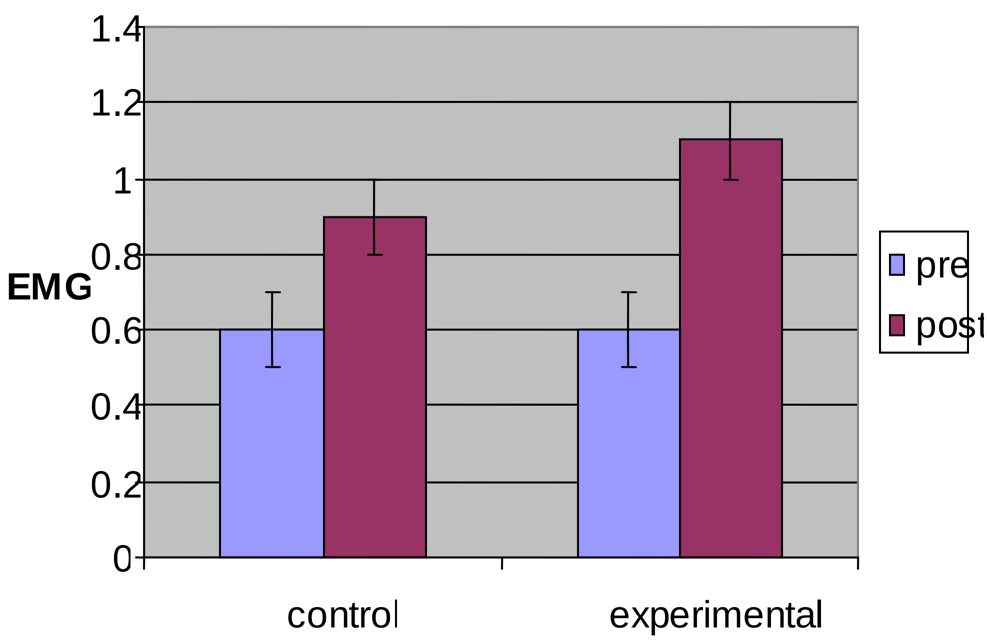

Fig3: EMG amplitude for Pelvic floor muscle in each group.

Differences in Cystometry test between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in the cystometry test measured before the experimental trial where the t value was -0.542, while P was 0.592, and moderate significant differences when measured post experimental trial where the t value was -15.944, while P was 0.001as shown in Table 6 and Fig4.

Table6: T-test between the two groups ofCystometry before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	117.3	±0.3	-0.542	0.592
	GII	118.3	±0.3		
Post-test	G I	160.8	±0.4	-15.944	0.001
	GII	196.8	±0.3		

Differences in Cystometry within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in cystometry test where the t value was -12.91, while P was 0.01, and moderate significant differences between pre and post test of group II where the t value was -23.44, while P was 0.001 as shown in Table7andFig4.

Table7: T-test within the two groups of Cystometry test before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	116.3	±0.3	**-12.91**	**0.01***
	Post	160.8	±0.4		
Group II	**Pre**	118.3	±0.3	**-23.44**	**0.001****
	Post	196.8	±0.3		

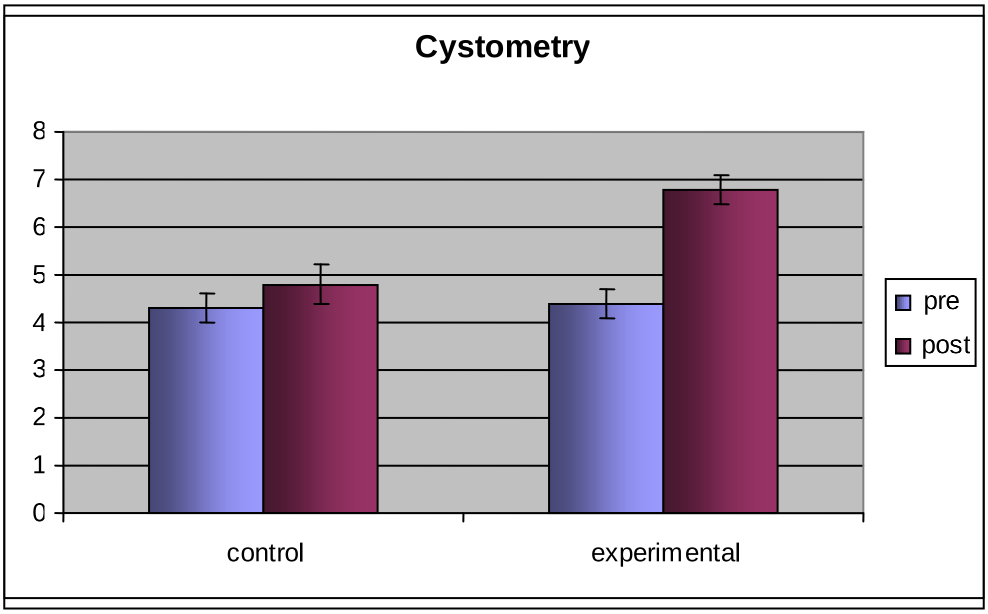

Fig4: The results of Cystometry in each group.

Differences in residual urine volume between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in the residual urine volume measured before the experimental trial where the t value was 0.6, while P was 0.97, and moderate significant differences when measured post experimental trial where the t value was -6.38, while P was 0.001as shown in Table 8 and Fig5.

Table8: T-test between the two groups of residual urine volume before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	108.64	±0.3	0.6	0.97
	GII	108.04	±0.3		
Post-test	G I	82.4	±0.4	-6.38	0.001**
	GII	60.7	±0.3		

Differences in residual urine volume within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in residual urine volumewhere the t value was -9.51, while P was 0.01, and moderate significant differences between pre and post test of group II where the t value was -14.4, while P was 0.001 as shown in Table 9 and Fig 5

Table9: T-test within the two groups of residual urine volume before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	108.64	±0.3	**-9.51**	**0.01***
	Post	82.4	±0.4		
Group II	**Pre**	108.04	±0.3	**-14.4**	**0.001****
	Post	60.7	±0.3		

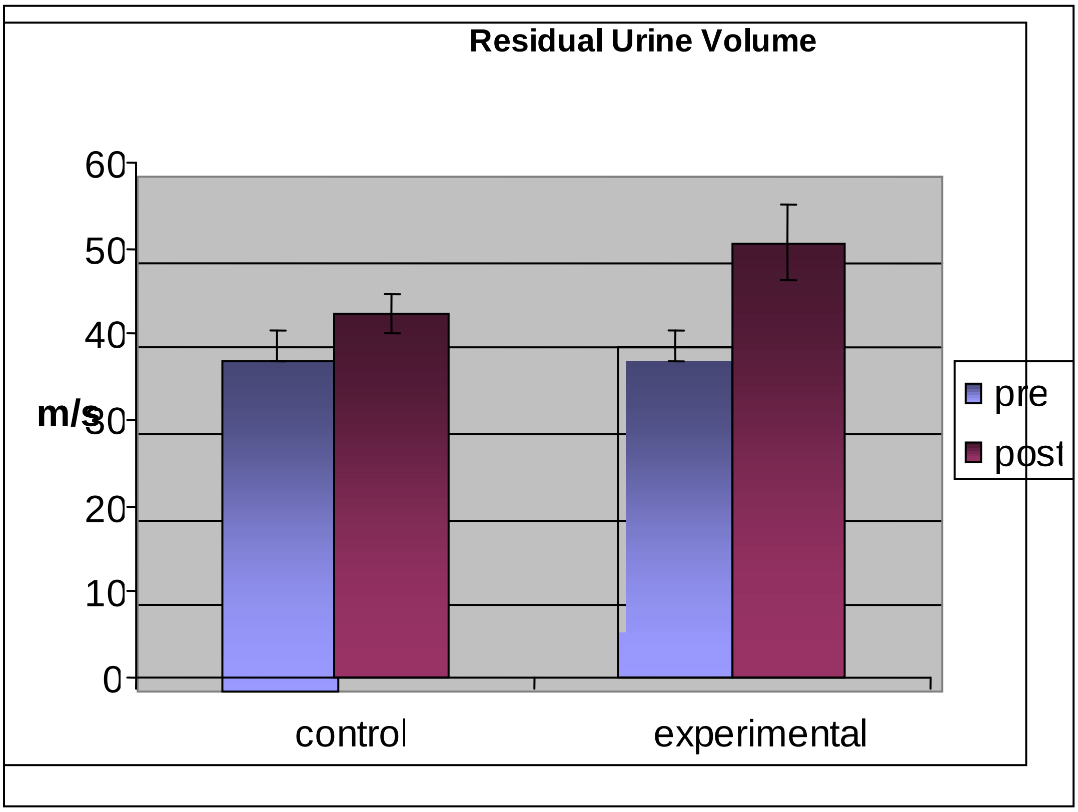

Fig5: Results of residual urine volume in each group.

Differences in biofeedback test for pelvic floor muscle between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in the Biofeedback test for pelvic floor muscle measured before the experimental trial where thet value was -0.38, while P was 0.707, and moderate significant differences when measured post experimental trial where the t value was 3.95, while P was 0.001as shown in Table10 and Fig6.

Table10: T-test between the two groups of biofeedback test for pelvic floor muscle before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	6.5	±0.5	-0.38	0.707
	GII	6.5	±0.5		
Post-test	G I	5.2	±0.5	3.95	0.001**
	GII	3.7	±0.3		

Differences in Biofeedback test for pelvic floor muscle within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in the Biofeedback test for pelvic floor muscle where the t value was 2.82, while P was 0.014, and moderate significant differences between pre and post test of group II where the t value was 10.46, while P was 0.001 as shown in table11 and Fig6.

Table11: T-test within the two groups of biofeedback test for pelvic floor muscle before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	6.5	±0.5	**2.82**	**0.014 ***
	Post	5.2	±0.5		
Group II	**Pre**	6.5	±0.5	**10.46**	**0.001****
	Post	3.7	±0.3		

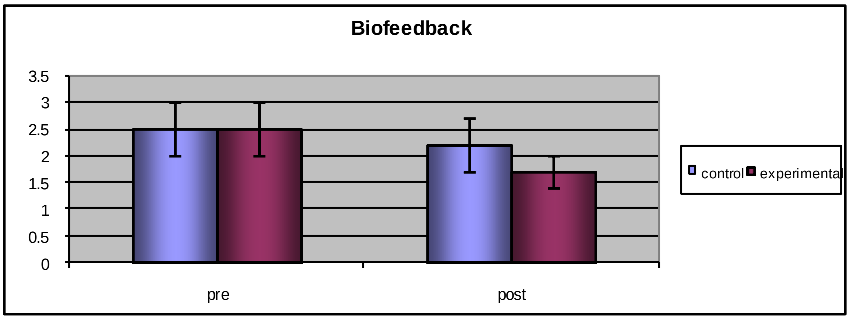

Fig6: Results of Biofeedback testfor pelvic floor muscle in each group.

Discussion

Although there have been several recent clinical studies showing the positive effect of percutaneous posterior tibial nerve stimulation on urinary incontinence in Paraparetic patients, such treatment hasn't been widely used in clinical setting yet[20]

Recently, our study is in accordance with[21]who demonstrated the efficacy of transcutaneous tibial nerve stimulation with the use of external electrodes. It is believed that the electrical stimulation can penetrate the skin delivering tibial nerve stimulation in the same way, but without the need for a needle electrode. A study reported that based on 7 case series 48-68% of patients treated via transcutaneous tibial nerve stimulation (external stimulation) was a marked improvement or cure of their bladder irregularities (varying forms of incontinence). This is in contrast to the 60-80% success rate for treating overactive bladder using the percutaneous method (use of a needle stimulator). The study concludes that transcutaneous tibial nerve stimulation has a positive impact and an overall reduction in bladder weakness symptoms.

PTNS described by[22]for the treatment of overactive bladder syndrome, situated 4–5 cm cephalad to the medial malleolus, and has previously been acknowledged as a neural access point for the regulation of bladder and pelvic floor function. Furthermore, experiments on animals demonstrated that the electrical stimulation of the hind leg produces detrusor inhibition. Basing his research on these concepts, the transcutaneous electric stimulation of the posterior tibial nerve can suppress neurogenic detrusor overactivity.

Several studies[23] have been published evaluating the effects of PTNS on urinary incontinence. According to these studies, the overall percentage of patients classified as "successfully treated" was 54.5-79.5%. Of note, the definition of "success" differs among studies from the use of urodynamic data to clinical parameters and quality of life measures. In spite of these differences, the reported success rates are of clinical interest, especially because many results were obtained from a population of patients who were already non responsive to conventional therapies. Improvements are reported not only in symptoms, but also in urodynamic observations reported a reduction of detrusor overactivity and increase of the cystometric capacity and of the threshold of appearance of involuntary detrusor contractions[24].

Our study agree with[22] who mentioned that, the electrical stimulation was applied unilaterally from the medial malleolus and posterior to the edge of the tibia by using charge-compensated 200 microsecond pulses with a pulse rate of 20 Hz. Mean first involuntary detrusor contraction on standard cystometry was 138.34 ± 6.36 mL (60 to 225 mL), whereas it was 230.48 ± 8.89 mL (145 to 375 mL) during PTNS. Mean maximum cystometric capacity on standard cystometry was 193.93 ± 9.90 mL (110 to 304 mL), whereas it was 286.48 ± 9.09 mL (221 to 376 mL) during stimulation. The improvements in the first involuntary detrusor contraction and maximum cystometric capacity were statistically significant during stimulation (P <0.001). The difference of mean first involuntary detrusor contraction volume and mean maximum cystometric capacity at baseline and after PTNS was statistically significant (P <0.001).These results have demonstrated the objective effect of acute PTNS on urodynamic parameters. PTNS is effective to suppress detrusor overactivity in MS patients.

Selecting among needle, wire, or surface patch electrodes is the first step toward ensuring optimal EMG tracings. Several studies[25] have compared the accuracy of surface versus needle electrodes for assessment of pelvic floor EMG, compared concentric needles to surface patches for recording EMG activity during micturition in 22 women undergoing urodynamics testing. They reported that tracings generated by concentric needle EMG had higher interrater reliability than tracings generated by surface electrodes. Moreover[26] compared concentric needle to patch electrodes in 25 children undergoing urodynamics testing, including filling cystometrogram and an additional 12 children undergoing EMG with uroflowmetry only. They found a statistically significant correlation between EMG tracings generated by surface patch and needle electrodes, and concluded that surface electrodes were preferable because they allowed movement during urodynamics testing and avoided percutaneous needle insertion.

Our study is closely related to several studies[27] illustrating assessment of EMG during micturition focuses on the response of the pelvic floor muscles and rhabdosphincter to micturition. During normal voiding, these muscles reflexively relax in response to neural modulation by the pontine micturition center. Failure of this coordinated response is called detrusor sphincter dyssynergia (DSD). It is caused by a neurological lesion affecting spinal segments below the pontine micturition center and above the sacral micturition center. Diagnosis during urodynamics testing is essential because DSD causes functional obstruction of the bladder outlet that often leads to upper urinary tract distress. DSD must be differentiated from other factors leading to EMG activity during micturition, including voluntary contraction of the pelvic floor muscles, abdominal straining, or artifact[28].

Our study is agreeing with[28]when demonstrated that, the biofeedback has been proven effective in the treatment of urinary incontinence in numerous research studies. It can be used to help women learn to control and strengthen the pelvic floor muscles. The pelvic floor muscles (PFM) are a group of muscles that play an important role in bladder control. Weakness or dysfunction of the pelvic floor muscles can lead to problems with both bladder and rectal support and control. Because you cannot see the pelvic floor muscles, you may have found it difficult to locate them. Perhaps you are uncertain if you are doing the pelvic muscle exercises correctly. This is where biofeedback can help.

Our study is in accordance with the largest study[30]compairing the effect of biofeedback, recruited 135 women, most of women in the study had a diagnosis of stress incontinence, and however a few 12 had mixed incontinence. All patients were subject to treatment by biofeedback devices for encouraging contraction of pelvic floor and detrusor muscles for 25-30 at least12weeks, day after day. The major outcomes measure was patient self reported urine loss via a symptom diary, this outcomes was assessed each week during treatment 2weeks, 4weeks, 6weeks to 12weeks following the completion of treatment which show that, there was a significant improvement in all patients.

Also, this study agree with[29] when recruited44 patients with stress incontinence from urologist and general practioners, after one week diagnostic phase, 40 patients were randomized to EMG biofeedback, all patients received 3 sessions of instruction per week for a 4 week. Outcomes measures report include frequency of urine incontinence by a patient diary and standardized pad test. There were significant improvement of pelvic floor and detrusor muscles contraction and decrease frequency of incontinence.

CONCLUSIONS

These results suggest an objective effect of percutaneous posterior tibial nerve stimulation on urodynamic parameters. Improved incontinence bladder is an encouraging argument to propose posterior tibial nerve stimulation as a noninvasive treatment modality in clinical practice. Finally PTNS is safe, with no major complications reported in literature. In consideration, of these potentialities, as suggested by some authors PTNS could be offered early in the course of urinary incontinence treatment.

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الملخص العربي

تأثير التحفيز اليوروديناميكى لعصب الحس خلف عظمة القصبة عن طريق الجلد على سلس البول في مرضى الشلل النصفي السفلي

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كان الهدف من هذه الدراسة هو تقييم مدى تأثير فعالية التحفيز اليوروديناميكى لعصب الحس خلف عظمة القصبة عن طريق الجلد على السلس البوليفي مرضى الشلل النصفي السفلى ولقد أجريت هذه الدراسة على 30 مريضاً مصابين بمرض السلس البولي من الرجال والسيدات، وتراوحت أعمارهم مابين 25 عاماً وحتى 40 عاماً، قسموا عشوائياً إلى مجموعتين متساويتين، بالنسبة للمجموعة الأولى، هيمجموعة مراقبة من حيث تم علاجهاببرنامج العلاج الطبيعي لتدريب المثانة (تمارين تقوية لعضلات البطن والحوض، والضغط والخدش والجليد على أسفل البطن) دون أي تحفيز ،أما المجموعة الثانية فهي المجموعة التجريبية فقد عولجت بنفس البرنامج العلاج الطبيعي بالإضافة إلى تطبيق التحفيز الكهربائي من الكعب الإنسي والخلفية إلى حافة الساق باستخدام200 ميكروثانية مع التردد 10 هرتز لمدة 30 دقيقة وذلك على مدار اثني عشرة اسبوعا ، ثلاث مرات أسبوعيا يوم بعد يوم، وتم إجراء القياسات الحيوية لجميع المرضى مثل ضغط الدم ودرجة الحرارة ومعدل ضربات القلب ومعدل التنفس لجميع المرضى ثلاثة مرات لكل مريض قبل، أثناء وبعد العلاج في كل جلسة. كما تم تقييمالمرضى قبل وبعد العلاج عن طريق اختبار البول عن طريق قياس المثانة و قياس حجم البول المتبقيوالارتجاع البيولوجي ، والاختبارات في جميع المرضى تم القيام بها قبل البدء في العلاج وبعد الإنتهاء من البرنامج العلاجي.

وقد أوضحت نتائج المعالجةوالتحليلات الإحصائية أن هناك تحسن إحصائي واضح ذو دلالة إحصائية لصالح المجموعة الثانية عن المجموعة الأولى ، فيما يتعلق بجميع المتغيرات (0.001>).الخلاصة:التحفيز اليوروديناميكى لعصب الحس خلف عظمة القصبة عن طريق الجلد هو وسيلة فعالة في علاج سلس البول عند مرضى الشلل السفلي ويعد على إنه طريقة علاج لسد الفجوة بين العلاجات المحافظة والجراحية في المرضى الذين يعانون من أنواع معينة من سلس البول.

الكلمات الدالة:تحفيز العصب ، المثانة، الارتجاع البيولوجي،رسم العضلات الكهربي، سلس البول، التوتر السطحي والشلل النصفى

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Scientific Conferences 2015

Mechanical Responses to Hip versus Knee Induced Muscle Fatigue in Patellofemoral Pain Syndrome

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Type of Participation: Search Study, Excellence in Research and Innovation for Humanity, PDF.

Abstract

Background: Impaired skeletal muscle endurance may be an important causal factor in the development of patellofemoral pain syndrome (PFPS). However, there is lack of information regarding the effect of hip versus knee muscle fatigue on isokinetic parameters, and myoelectric activity of hip and knee muscles in these patients. **Purpose:** The study was conducted to investigate the effect of hip abductors versus knee extensors fatigue protocol on knee proprioception, hip and knee muscle strength and their myoelectric activity in patients with PFPS. **Methods:** Fifteen female patients with PFPS participated in the study. They were tested randomly under two fatiguing conditions; hip abductors and knee extensors fatigue protocols. Isolated muscle fatigue of two muscles was induced isokinetically on the affected side in a two separate sessions with a rest interval of at least three days. After determining peak torque, patients performed continuous maximal concentric-eccentric contraction of the selected muscle until the torque output dropped below 50% of peak torque value for 3 consecutive repetitions. Knee proprioception, eccentric hip abductors' peak torque, eccentric knee extensors' peak torque, EMG ratio of vastusmedialisobliquus (VMO) / vastuslateralis (VL), and EMG activity of gluteus medius (GM) muscle, were recorded before and immediately after each fatigue protocol using the Biodex Isokinetic system and EMG Myosystem. **Results:** Two-way within subject MANOVA revealed that eccentric knee extensors' peak torque decreased significantly after hip abductors fatigue protocol compared to pre fatigue condition ($p<0.05$). On the other hand, there was no statistically significant difference in the eccentric hip abductors' peak torque after admitting knee extensors fatigue protocol ($p>0.05$). Moreover,no significant difference was found in knee proprioception, EMG ratio of VMO / VL, and EMG activity of GM muscle, after either hip or knee fatigue protocol ($p>0.05$). **Conclusion:**A hip focused rehabilitation program may be beneficial in improving knee function through correcting faulty kinematics and hence decrease knee loading in patients with PFPS.

Keywords: Mechanical Responses, Muscle Fatigue, Knee Proprioception, Electromyography, Patellofemoral Pain Syndrome.

Introduction

Patellofemoral pain Syndrome (PFPS) is defined as diffuse anterior or retropatellar knee pain exacerbated by activities such as stair climbing, prolonged sitting, kneeling, running and squatting. It is apathology in which patella is translated or tilted laterally leading to alteration in patellofemoral contact pressure.

Pathomechanics

Several risk factors may lead to Patellar mal-alignment such as proximal factors (Hip muscle weakness) and Localized factors (Muscle imbalance). Biomechanically, the pennation angle of the VMO muscle is well suited to apply a medially directed force to the patella. On the other hand,Vastusmedialisobliquus muscle has low contraction velocity and always is inhibited due to Q angle. Additionally, Vastuslateralis muscle has large contraction force and high contraction velocity. Recently, it was reported that functional mal-alignment does not arise in the knee joint but rather by internal rotation and adduction of the femur due to weakness of hip external rotators and abductors. (Petersen et al., 2013).Weak hip abductorsleads to lateral translatory motion (lateral patellar mal-tracking). Weak hip external rotators leads to lateral angular motion (lateral patellar tilt).

Proprioception

The proprioceptive system contributes to JPS, joint motion sense, and kinesthesia. This includes the sensations of muscle length and tension, joint angles, and changes in these angles (Kars et al, 2009). Proprioception is an action-reaction mechanism. voluntary and spinal reflexes are important in sending messages to the muscles to react and protect the body. Proprioception is important in maintaining joint stability. Thus, if the muscles are fatigued, voluntary and spinal reflex time increases and proprioception performance decreases, resulting in incorrect joint position during weight bearing activity and decreased joint stability and an increased in the probability of injury (Kruger et al, 2004). (through increase joint reaction force).

Also, Proprioception impairment may lead to several musculoskeletal disorders by disrupting the control of movement leading to abnormal stresses on tissues. It was reported that, the onset of VMO relative to VL is usually delayed in patients with PFPS due to abnormal proprioception from the surrounding articular

Muscle fatigue

Muscle fatigue is defined as the decline in force output capacity after repeated muscle contractions (Hossein et al., 2013). It has been postulated that, increased fatigability followed by muscle weakness is one of the primary symptoms of patients with different musculoskeletal disorders. Therefore,our purpose of the current study was to investigate the effect of induced hip and knee muscle fatigue protocols on knee proprioception, isokinetic peak torque and myoelectric activity of knee extensors and hip abductors in patients with patellofemoralpainsyndrome.

Methods

This study involved 15 female patients with PFPS. All patients had anterior or retropatellar knee pain after performing at least two of the following activities: prolonged sitting, stair climbing, squatting, running, kneeling, hopping/jumping, ascending or descending stairs, and deep knee flexion. All patients had Q angle ranged between 20° -22°.

2- Positive signs of anteirior knee pain during initial physical examination pain following isometric quadriceps contraction (Clarke's sign).

3- Pain following compression of the patella against the femoral condyles (Patellar grind test).

4- Functional performance ranged between 65-84 (according to Kujala questionnaire) (Scale designed to measure function in the individuals with anterior knee pain)

5- Knee pain ranged from 3 to 10 according to 10 cm visual analogue scale (VAS)

(One of the frequently used methods of assessing pain in the clinical environment)

Instrumentation:

1- Isokinetic dynamometer

Biodex was used to induce knee extensors', hip abductors' and external rotators' fatigue protocol, measuring knee joint proprioception and the eccentric peak torques of the selected muscles at an angular velocity 60 degree/sec.

2-Electromyography apparatus (EMG)

EMG apparatus was used to DETECT changes in the interference patterns of the EMG of the examined muscles (VMO, VL, and GM muscles).

Procedures

This study involved a within-subject experimental design in which one group of patients processing under both fatiguing conditions

At first, he recording data sheet was filled in for each patient then each patient was instructed to pick up one of two papers from a container for random selection. These two papers represent the two fatiguing protocols (hip or knee fatigue protocols).

If the chosen fatigue protocol was the hip abductors: The following pre fatigue procedures were done.
Firstly:
EMG electrodes were placed at the motor points of the tested muscles (VMO, VL, and GM muscles). VMO electrodes were placed approximately 4 cm superior and medial to the superomedial border of the patella. Also, it was oriented at 50-55o to the reference line (A line drawn from ASIS to center of patella). The VL electrodes were placed 10 cm superior to the superolateral border of the patella at approximately 15o to the reference line. For GM muscle, electrodes were placed half the distance between the iliac crest and greater trochanter.
Secondly:
Patients were asked to ascend and descend two steps of 20 cm height, 55cm length, and 25cm width starting with the tested limb followed by the contralateral during ascending and descend first with untested limb.
Then, Knee proprioception was measured at angle 45 degree of knee flexion. Patients were blindfolded. The patient's leg was placed at a starting angle of 90o knee flexion for each trial. Then it was moved passively to the tested angle (45o of knee flexion) by the dynamometer. Patient was asked to concentrate on the sensation of the presented angle for 5-seconds. The leg was then returned passively to the starting position by the examiner. After 5-seconds rest period the patient was attempted to actively reproduce the presented joint angle for another five seconds. Three trials were performed and the average was taken for statistical analysis. Knee extension strength test was performed with concentric-eccentric mode of contraction. Patients were instructed to perform five maximal concentric –eccentric contractions at an angular velocity 60 degree per second

Just before conduction of hip fatigue protocol, hip abductors' eccentric peak torque was recorded. For measuring Hip abductors' peak torque, (five repetitions of concentric/eccentric contractions for hip abduction and external rotation were performed).

Fatigue protocol

Fatigue protocol = At first, three trials of sub-maximal and three of maximal contractions were performed. After a 60 seconds rest and in order to determine peak torque, three repetitions of maximal concentric-eccentric contraction were performed with no rest in between. The highest torque achieved during the patients were instructed to perform continuous maximal concentric-eccentric contractions of the target muscle at 60^{o}/s until the torque output dropped below 50% of the peak torque for three consecutive contractions. Three repetitions were considered as peak torque. After two-three minutes, patients were instructed to perform continuous maximal concentric-eccentric the same procedures were done after knee fatigue protocol. Immediately after performing the fatigue protocol, knee proprioception was measured first, then knee extensor and hip abductor muscle strength and finally EMG activity was recorded again.

Statistical analysis

In the current study, two independent variables and five dependent variables were tested**.** Two independent variables = first one was fatigue type which has two levels (hip and knee fatigue). Second independent variable was fatigue time which has two levels (pre and post fatigue). The five dependent variables (knee proprioception, eccentric hip abductors' and external rotators' peak torques, eccentric knee extensors' peak torques, EMG ratio of VMO/VL, and EMG activity of GM muscle).

- This was conducted through assessing the level of significance of normality tests, skewness and kurtosis, and extreme
- Once data were found not to violate the normality assumption, after that, appropriate statistical test was conducted (Two-way within subject MANOVA).Multiple pairwise comparison tests. Level of significance was set at .05.

Results

Regarding knee proprioception, two way within subject MANOVA revealed that there was no statistically significant difference in knee proprioception between pre and post fatigue conditions after either hip or knee fatigue protocol. As noted after hip fatigue protocol, increase in absolute angular error was found but not reach statistical significance. P value was 0.07. Additionally, regarding eccentric knee extensors' peak torque, there was a statistically significant reduction of eccentric knee extensors' peak torque at both hip and knee fatigue protocols.

Concerning eccentric hip abductors' peak torque, there was a statistically significant reduction of eccentric hip abductors' after hip fatigue protocol compared to the prefatigue condition. On the other hand, no significant difference was found in the eccentric hip abductors' peak torque between pre and post knee fatigue conditions.

Two way within subject MANOVA indicated that there was, no statistically significant difference was found after eitherVMO/VL EMG ratio hip or knee fatigue protocol. However, when the EMG activity of each muscle was analyzed individually, the results revealed significant increase in their activity.Regarding EMG activity of GM muscle, no statistically significant difference was found between pre and post fatigue conditions after either hip or knee fatigue protocol

Discussion

Knee proprioception

The increase in absolute angular error noted in knee proprioception after fatigue protocol of hip abductors might be attributed to

- Greater lateral quadriceps force. This will lead to Increase retropatellar stress and Peripatellar plexus dysfunction leads to impaired proprioception through affecting mechanoreceptors.
- **The insignificant difference in knee proprioception after conducting knee extensors fatigue protocol may be due to**

1- Localized fatigue protocolused (General fatigue which affects other mechanisms in the proprioceptional pathway).

2- Modulating the number and/ or firing rate of active motor units (2-modulating the number and/ or firing rate of active motor units through adding new unfatigued large motor units to prevent the decline of force generating capacity.

3- Agonist muscle fatigue (It was reported that fatigue of hamstring would lead to decreased sensory output of the muscle spindles associated with the hamstrings. Since muscle spindles are stretch receptors, decreased afferent output of the sensory organs in the posterior compartment of the thigh should lead to a decrease in proprioception, in particular joint position sense, with movement into extension.

Eccentric knee extensors' peak torques

Statistically significant reduction in eccentric peak torque of knee extensors after hip abductors fatigue might be attributed to:

1- Central fatigue: Central fatigue, prolonged exertion used in the current fatigue protocol is believed to cause both peripheral and central elements of neuromuscular control; referred to as peripheral fatigue and central fatigue. Central fatigue might play an important role in the reduction of the firing frequency of the motor units.

2- Alteration in hip mechanics in the form of increased hip adduction and internal rotation of the femur leads to increase peak contact pressure on the posteirior patellar surface. Increase stress leads to increase pain. Pain causes inhibition of the alpha motor neuron and prevents the full activation of quadriceps specifically; VMO muscle compared with other vastus components. Pain leading to reduced force production (torque).

Eccentric hip abductors' peak torques

1- The insignificant difference in hip abductors' strength following fatigue of knee extensors might have occurred through: Insignificant reduction in eccentric hip abductors' peak torque might be due to increase firing level of gluteus maximus muscle.. Since the exercise strngth testing in the current study measured from open kinetic chain, the main role of gluteusmaximus is to control hip adduction and internal rotation instead ofgluteusmedius which is required mainly to stabilize frontal plane motion from weight bearing position.

2- Also, during seated fatigue position, the rectus femoris is functionally weaker. It is biarticular muscle, acting as a flexors on the hip joint and as extensors on the knee muscles. During knee extension fatigue protocol, it acts mainly on the knee joint and isolated on the hip joint. Therefore, an ineffective transfer of torque from the knee to hip joint leads to insignificant fatigue effect.

In the current study, fatigue of hip abductors affected knee extensor's strength. On the other hand, fatigue of knee extensors did not have effect on hip muscles. This could relate to different responses of these muscles to fatigue.

Hip abductors are stabilizing muscles which are prone to weakness and inhibition. Therefore, they are less activated in most functional movement's patterns, and fatigue easily during dynamic activities. On the other hand, knee extensors are mover groups that readily activated during most functional movements and resistant to fatigue

VMO/ VL EMG ratio

Insignificant difference in VMO/VL EMG ratio might have occurred due to increase EMG activity of both VMO and Vl muscles when analyzed individually. Fatigue leads to increase increase recruitment of additional motor units and increase amplitude of EMG activity. After knee muscle fatigue.It was found that, rectus femoris (RF) muscle fatigued to agreat extent than VMO and VL muscles. Therefore, EMG activity of VMO and VL increased significantly to compensate great fatigue effect of RF muscle.Meanwhile, after hip fatigue the cause of increased activity of both VMO and VL muscles was mainly due to decreased knee extensor muscle strength. Two mechanisms of decreased knee extensors strength after hip muscle fatigue were found. Firstly, Increase knee valgus after fatigue of hip abductors was found. Knee valgus angle leads to increased knee abduction ROM which supported by researchers (Dierks et al., 2008; Willson et al., 2008). Increased knee abduction ROM leads to increased knee adduction moment. The quadriceps muscle group generates an abduction moment to resist the internal knee adduction moment. This leads to decreased knee extensor muscle strength. Additionally, EMG activity of VMO and VL muscles was recorded during ascending and descending stairs. Women tend to land with less knee flexion angle when testing knee kinematics during landing after hip abductor fatigue protocol (Jacobs et al., 2007). Quadriceps extension moment was especially influenced knee flexion angle. This was attributed to the relation of soft tissue length and eccentric tissue tension according to rule of length tension relationship.

EMG activity of the GM muscle

1- The lack of diminished neuromuscular control after hip abductors and knee extensors fatigue protocol might be related to the nature of task performed. EMG activity of GM muscle which was recorded during ascending and descending stairs. Such exercises induce coactivation that is based on the characteristics of closed kinetic chain exercise ((Myers et al., 1999; Timothy et al., 2001). These characteristics include compression of the femoral head within the acetabulum. The stimulation of the articular mechanoreceptors elicits a coactivation response of trunk musculature (Neumann, 2010). Thus, there was no decrease in neuromuscular control of GM muscle post fatigue.

2- Also, Insignificant difference of EMG activity of GM muscle may related to, Lateral trunk lean might be occurred during stair stepping task. Passive moment of stance hip abductors produced as a result of shifting center of mass over the hip joint center. Therefore, the amount of force and activity level was equalized and no significant difference was found

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Effect of Rhythmic Auditory Stimulation on Gait in Patients with Stroke

Mohamed Ahmed Fouad Ibrahim

The Macro Trend Conference,Paris – France, December 21-22 2015.

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Type of Participation: Abstract (Master Thesis. 2014. Library register number 3775-3776).

Abstract

Background: Stroke is the most leading cause to functional disability and gait problems. **Objectives:** The purpose of this study was to determine the effect of rhythmic auditory stimulation combined with treadmill training on selected gait kinematics in stroke patients. **Methods:**Thirty male stroke patients participated in this study. The patients were assigned randomly into two equal groups, (study and control). Patients in the study group received treadmill training combined with rhythmic auditory stimulation in addition to selected physical therapy program for hemiparetic patients. Patients in the control group received treadmill training in addition to the same selected physical therapy program including: strengthening, stretching,weight bearing, balance exercises and gait training. Biodex gait trainer 2 TM was used to assess selected gait kinematics (step length, step cycle, walking speed, time on each foot and ambulation index) before and after six weeks training period (end of treatment) for both groups. **Results:** There was a statistical significant increase in walking speed, step cycle, step length, percent of time on each foot and ambulation index in both groups post treatment. The improvement in gait parameters post treatment was significantly higher in the study group compared to the control. **Conclusion:** Rhythmic auditory stimulation combined with treadmill training is effective in improving selected gait kinematics in stroke patients when added to the selected physical therapy program.

Key words: Stroke, Rhythmic Auditory Stimulation, Treadmill Training.

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Effect of kinesio Tape in Myofascial Pain Syndrome Randomized control trial

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The 30th Annual Kinesio TapingInternational Research Symposium**, November 21-23, 2015.**

Type of Participation: Search Study**.**

Introduction

Myofascial pain syndrome is one of the most common examples of musculoskeletal pain; an accumulating body of evidence suggests that unique hypersensitive loci, named Myofascial trigger points.

Kinesio tape is a technique developed by Dr. KenzoKase in The 70s. The adhesive pliable material, directly applied to the skin, differs from classical tape in its physical characteristics. Furthermore, its clinical application departs from the usual restriction of mobility. This technique claims four effects, normalizing muscular function, increasing lymphatic and vascular flow, diminishing pain and aiding in the correction of possible articular misalignments. Kinesio tape technique is frequently applied for pathologies in the musculoskeletal system**.**

Purpose

This study was conducted to show the efficacy ofkinesio tape technique on the pain threshold, functional level and pain severity levels on neck myofascial pain syndrome patients in randomized trial.

Participants

Thirty patients with myofascial neck pain syndrome assigned randomly into: kinesio tape group and control group.

Methods

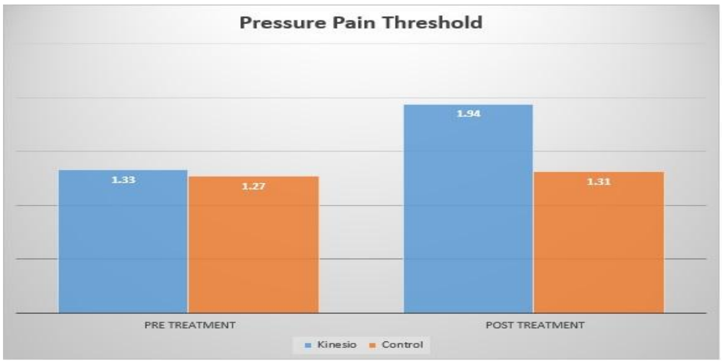
kinesio tape was applied for upper Trapezius muscle for two weeks (3days on and one day off). Pressure algometry, Visual analogue scale (VAS) and Neck disability index (NDI) were used to evaluate participants before and after the corresponding interventions.

Kinesio tape technique Begin from Insertionofupper fibers of trapezious

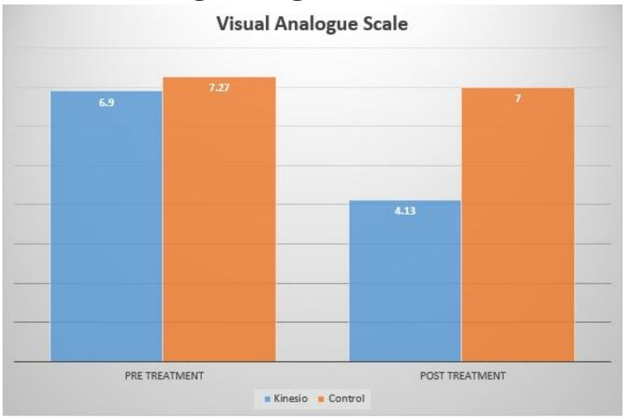
Kinesio tape technique End in the Originof upper fibers of trapezious

Results

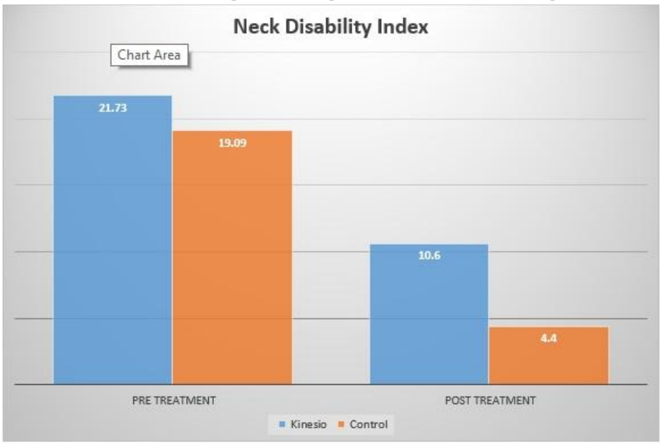
For the 30 study participants (15 women and 15 men; mean age=44.1±7 years) statistical analysis revealed that Subjects of kinesio tape group experienced significant increase in pressure pain threshold, decrease in neck disability scale and pain level than those in the control group (p>0.05)



Results of ANOVA regarding Pressure Pain Threshold PPT



Results of ANOVA regarding Visual Analogue Scale VAS



Results of ANOVA regarding Neck Disability Index NDI

Discussion & Conclusions

This study might assists in the understanding the efficacy of kinesio tape technique on neck myofascial pain syndrome. kinesio tape techniques for patients with MPS have a strong positive impact on pain severity, pain threshold and functional levels in comparing to control group which more effective to MPS patients. Follow up measurement revealed stable improvement in all measured variables. These observed effects should be of value to clinicians and health professionals involved in the treatment of neck myofascial painsyndrome .

Recommendations

Further randomized control trials to be conducted to investigate the effect kinesio taping on disc Prolapsed, forward head posture, absolute relative angle or Cobb's angle of cervical curvature.

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Mechanical Response of Hip and Knee Muscles Following Randomized Crossover Trials in Patellofemoral Pain Syndrome

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2nd Medinah International Conference for Medical Rehabilitation Updates, Kingdom of Saudi Arabia, November3-6 2015.

Type of Participation: Search Study (Doctoral Thesis. 2015. Library register number 4111-4112).

Abstract

Background: Faulty hip kinematics during weight bearing activities is proposed to contribute to patellofemoral pain syndrome (PFPS). However, limited information exists to determine the effectiveness of exercises programs that not only act on the knee joint, but also on the hip joint in these patients. **Purpose:** The purpose of this study was to compare between the effect of the starting of hip strengthening exercises before knee exercises program and the starting of knee exercises program before hip strengthening exercises on pain intensity, Kujala questionnaire scale, Q angle, anteversion angle, and knee extensors, hip abductors and lateral rotators peak torques (PT) in patients with PFPS. **Materials and Methods:** Twenty four patients suffering from PFPS were randomly assigned into two equal groups of twelve. Group (A) mean age, weight, height and BMI values were 23.33±5.39 years, 71.16±13.05 kg, 164.75±4.5 cm, and 26.21±4.71 kg/m² respectively. They received hip abductors and external rotators strengtheningexercises for three weeks followed by knee extensors strengthening exercises and stretching exercises for quadriceps, hamstring, gastrocnemus muscles and iliotibial band for another three weeks. Group (B) with mean age, weight, height and BMI values were 23.16±6.33 years, 69.41±18.14 kg, 164.66±7.27 cm, and 25.2±6.2 kg/m² respectively. They received knee extensors strengthening exercises and stretching exercises for quadriceps, hamstring, gastrocnemus muscles, and iliotibial band for three weeks followed by hip abductors and external rotators strengthening exercises for another three weeks. Both groups received three to four sessions per week for six weeks. Pain level, Kujala scale, Q-angle, anteversion angle, and isokinetic eccentric PT for hip abductors, hip external rotators, and knee extensors were recorded before, after three weeks, and after six weeks of exercises. **Results:** 2x3 Mixed Design MANOVA revealed that there was a significant reduction in level of perceived pain and improvement of Kujala scale in group (A) compared with group (B) after six weeks of exercise ($p<0.05$). However, there was no significant difference in the Q angle, anteversion angle, and isokinetic eccentric PT for hip abductors, hip external rotators and knee extensors between the tested groups after six weeks of exercise ($p>0.05$). **Conclusion:** Starting rehabilitation program with hip strengthening exercises is more effective than starting with knee strengthening and stretching exercises in reducing pain and improving Kujala scale in patients with PFPS. Consequently, this may help physiotherapists in designing the most effective and efficient prevention and rehabilitation programs for patients suffering from PFPS.

Key words: Patellofemoral Pain Syndrome, Hip, Knee, Strengthening Exercises, Q-Angle, Anteversion Angle.

Introduction

Patellofemoral pain syndrome (PFPS) is a common complaint in athletes and general populations especially in which repetitive lower limb loading is involved. It is more prevalent in female than in male with reported incidence rates in physically active young adult greater than 25 %[1]. PFPS was known by such terms as anterior knee pain, patellofemoral dysfunction, patellar subluxation or patellar compression syndrome[2].

Although the etiology of PFPS was not exactly understood, repetitive loading of patellofemoral joint caused damage in retropatellar cartilage and subchondral bone[3]. Strength imbalance in extensor mechanism results in patellofemoral pain by stimulating nociceptive fibers in synovium and retinaculum[4]. Patellofemoral joint reaction forces increased on conditions like running, stair-climbing and descending, slope-climbing and descending, or sitting at flexion angles at 90° or more, and impose too much pressure on patellofemoral joint, therefore caused an increase in pain complaints in patients[5,6]. One of the most commonly accepted causes of PFPS was abnormal tracking of the patella within the femoral trochlea. Potential contributing factors that have been studied include vastusmedialisobliquus insufficiency, decreased flexibility of soft tissues around the knee[7].

Some theories for the origin of nontraumatic gradual onset of PFPS are: (1) neuromuscular imbalance of the vastusmedialisobliqus (VMO) and the vastuslateralis (VL) muscles; (2) tightness of the lateral knee retinaculum, hamstrings, iliotibial band, and gastrocnemius; and (3) overpronation of the subtalar joint[8, 9]. Previous literatures suggested that, in the absence of direct trauma, the etiology of PFPS is multifactorial. Factors related directly to the patellofemoraljoint[10]and factors distal to the knee have also been frequently suggested to contribute to patellofemoralmalalignment and pain[11, 12]. Proximal factors including hip muscle weakness have been proposed to contribute to patellofemoralmalalignment and the development of PFPS[4, 13]. Hip musculature plays an important role in controlling transverse-plane and frontal-plane motions of the femur[14, 15, 16].

Strong evidence was reported for a decrease in hip external rotation, abduction, and extension strength and moderate evidence for a decrease in flexion and internal rotation strength, but no evidence for decrease in hip adduction strength in cases of PFPS compared with healthy controls[17]. Treatment of PFPS is varying and controversial. It is generally agreed that PFPS should be managed initially by conservative rather than surgical means[2]. However, no single intervention has been demonstrated to be the most effective. Conservative treatment include taping, strengthening of the quadriceps muscle, flexibility training, biofeedback, manual therapy to the lower quarter, and fitting of foot orthoses[18,19,20,21]. When treating patients with PFPS who demonstrate lack of control of hip adduction and internal rotation during weight-bearing activities, one goal may be to optimize hip muscle function to control these motions [22].

Rehabilitation programs focusing on knee strengthening exercises and the hip flexors, abductors, and external rotators strengthening were related to successful treatment as defined by at least 15% pain reduction on a pain visual analogue scale[23]. Program of isolated hip abductor and external rotator strengthening was effective in improving pain and health status in females with PFP compared to a no-exercise control group[24]. The incorporation of hip-strengthening exercises should be considered when designing a rehabilitation program for females with PFP. But to the author's knowledge, there is no previous study compared between the carry over effect of starting the isolated hip abductors and external rotators strengthening exercises before the knee strengthening and stretching exercises versus starting the knee strengthening and stretching exercises before the isolated hip abductors and external rotators strengthening exercises. So, in this study the researchers investigated the carry over effect of starting the isolated hip abductors and external rotators strengthening exercises before the knee strengthening and stretching exercises versus starting the knee strengthening and stretching exercises before the isolated hip abductors and external rotators strengthening exercises on pain level, Kujala questionnaire scale, Q angle, anteversion angle, and isokinetic eccentric peak torques of knee extensors, hip abductors and lateral rotators in patients with PFPS.

METHODS

Subjects

Twenty- four patients with PFPS with an age rang of 18-35 years signed an informed consent to participate voluntarily in the study. After a brief orientation session about the nature of the study and the tasks to be accomplished, they were randomly assigned into two equal groups by a blinded and an independent research assisstant who opened sealed envelopes that contained a computer generated randomization card. Group (A):study 1 consisted of twelve patients (10 females and 2 males) with mean ± SD age, weight, and height of 23.33±5.39 years, 71.16±13.05 kg, and 164.75±4.5 cm respectively. They started their rehabilitation program with hip strengthening exercises (hip abductors and lateral rotators) for three weeks then all dependent variables were measured. This is followed by open kinetic chain strengthening exercises for the knee (terminal knee extension and straight leg raisings) and stretching exercises for tight lower extremity soft tissues (quadriceps, hamstring, iliotibial band, and gastrocnemius) for another three weeks then measuring all dependent variables again.

Group (B):study 2 consisted of twelve patients (7 females and 5 males) with mean ± SD age, weight, and of 23.16±6.33 years, 69.41±18.14 kg, and 164.66±7.27 cm respectively. They started by open kinetic chain strengthening exercises for the knee (terminal knee extension and straight leg raisings) and stretching exercises for tight lower extremity soft tissues (quadriceps, hamstring, iliotibial band, and gastrocnemius) for three weeks after which all dependent variables were measured. Then hip strengthening exercises (hip abductors and lateral rotators) were conducted for another three weeks then measuring all dependent variables again.

. All participants were referred from the same orthopedic surgeon who was informed of patient inclusion and exclusion criteria. Patients were included if they had anterior or retropatellar knee pain from at least 2 of the following Activities[7]: (1) prolonged sitting; (2) stair climbing; (3) squatting; (4) running; (5) kneeling; and (6) hopping/jumping. Insidious onset of symptoms unrelated to a traumatic incident and Persistent for at least six weeks. Patients were excluded if they had history of any of the following condition: meniscal or other intra articular pathologic conditions; cruciate or collateral ligament involvement, patellar subluxation or dislocation, previous surgery in the knee and hip joints, Knee and hip joints osteoarthritis, fixed flat foot and a history of any conditions affects muscle strength as diabetes mellitus or rheumatoid arthritis. Of the intial 36 pateints recruited over 10-month period, two were excluded due to fixed flat foot and two refused to participate in the study for work reasons, four participants were evaluated before intervension and took treatment then unabled to come for evaluation after treatment due to political reason and four participants were evaluated before intervension but did not receive any treatment immediately after pre evaluation due to their work reason so we decide to exclude them as shown in figure 1 . So only twenty-four were included in this study and analyzed in our statistical test. We estimated our sample size depending on the work of Khayambashi et al[24] who assessed twenty-eight participants and demonstrated that program of isolated hip abductor and external rotator strengthening was effective in improving pain and health status in females with PFP compared to a no-exercise control group.

Study design

The study was designed as a prospective randomised clinical trial and patients were assigned to either group A or group B were randomly by a blinded and independent research assisstant who open sealed envelopes that contained a computer generated randomization card . Randomization was used to prevent bias.

Outcome measures

Before treatment, after 3 weeks, and 6 weeks of intervention, pain level and Kujala questionnaire for patellofemoral joint pain were recorded. A10-cm visual analogue scale (VAS) range from zero as "no pain" to 10 as "the worst pain possible". The participants were asked to rate their response based on the average pain in the knee during the previous week. The procedure is valid, reliable and responsive in assessing the outcome in persons with PFPS[25,26].

The participants function status was assessed using Kujala questionnaire for patellofemoral joint pain[26]. It is a 13-items knee specific self-report questionnaire, it documents response to six activities thought to be associated specifically with anterior knee pain syndrome (walking, running, jumping, climbing, stairs, squatting, and sitting for prolonged peroids with knees bent), as well as symptoms such as limp, inability to bear weight through the affected limb, swelling, abnormal patellar movement, muscle atrophy, pain and limitation of knee flexion. The maximum total score of this assessment tool is 100, with higher scores indicating greater levels of function with lower levels of pain. This scale shows high test-retest reliability, moderate responsiveness, and adequate validity[26].

The Q angle was measured by the same physical therapist,while the subject was in a weight-bearing position with feet in neutral position and quadriceps relaxes during measurement. The Q angle was measured by placing the goniometer axis at the center of the patella, with the stationary arm aligned to the anterior superior iliac spine and the movable arm aligned to the tibial tuberosity[27]. This method of assessing Q-angle, however with the use of universal goniometer, has been reported to have an ICC of 0.89 to 0.98 for intratester reliability[28].

As described by Ruwe et al[29] , femoral neck anteversion is assessed while the pateint lying prone, the examiner stood on the contralateral side: the left hand was used to palpate the greater trochanter while the right hand internally rotates the hip, with the patient’s knee flexed to 90 degrees. At the point of maximum trochanteris prominence, the femoral neck was horizontal. The angle subtended between the tibia and the true vertical, represents the femoral neck anteversion. The angle was measured with a goniometer.This method with the use of standard goniometer has been reported to have an interclass correlation co-efficient (ICC) of 0.77 to 0.97 for intratester reliability[28].

- **Hip abduction strength test:**

The seat and dynamometer attachment were adjusted as in hip external rotation except that seat orientation was 0º, and seatback tilt fully reclined. The participants laid in side-lying position on the reclined chair of the apparatus with his back facing the dynamometer, the tested leg was the upward one, and the thigh of the non tested leg and trunk was stabilized with straps. The axis of rotation of the dynamometer was aligned superior and medial to greater trochanter of the tested leg. The seat height and position was adjusted for accurate alignment. The thigh pad was connected to the hip attachment and its length was adjusted to be proximal to the patient's lateral femoral condyle then its strap secured the thigh pad. The dynamometer ROM was set at 30º hip abduction to 0° (neutral position) and neutral position was used as starting position. After two trial repetitions, the test was conducted.

- **Hip external rotation strength test:**

The positions of the seat and the dynamometer was adjusted for measuring hip joint for external rotators: dynamometer orientation 0º, dynamometer tilt 0°, seat orientation 90°, and seatback tilt 85º. The attachment of the hip (of the involved side) was attached to the dynamometer. The participant sat on the chair of the apparatus with the hip and knee flexed 90°. The axis of rotation of the dynamometer was aligned with the longitudinal axis of the femur. The seat height and position were adjusted for accurate alignment. The calf pad was connected to the hip attachment and its height was adjusted to be proximal to the patient's lateral maleolus then the calf pad was secured by its strap. Shoulder and thigh stabilization straps were fastened.The dynamometer ROM was set at 30º external rotation to 0º (neutral position) and neutral position was used as starting position. After two trial repetitions, the test was conducted. The patient was verbally encouraged to maintain muscle contraction through the test.

- **Knee extensors muscles strength test:**

All strength testing was performed with concentric/eccentric mode of muscle contraction at an angular velocity of 90º/sec. Patients with anterior knee pain should perform isokinetic eccentric contraction of the knee extensors at an angular velocity 90º/sec. This will avoid high compressive forces on the articular surfaces of the knee joint when using angular velocities below 90º/sec (Alfonso, 2011). So, the researcher selected this angular velocity. The dynamometer orientation was adjusted according to the standard instructions for knee testing so that the dynamometer head and chair were rotated to 90º. The biodex system was powered on, and the dynamometer was initiated. Then the knee attachment was secured on the dynamometer head. Each participant sat on the chair with hip flexion approximately 110º. Shoulder and waist straps were secured for stabilization and prevention of trunk motion.

The dynamometer seat back was inclined to 100º. With the tested knee positioned at 90º flexion, the axis of rotation of the dynamometer was aligned with the axis of rotation of the knee which is located at the posterior aspect of the lateral femoral condyle. A gap of 3-cm were left between the popliteal fossa and the seat cushion to permit free knee extension. The calf pad was connected to the knee attachment and its height was adjusted to be placed 4-cm proximal to the medial malleous and secured with the padded shin.

The subject was asked to grasp the dynamometer seat with both hands. Limits of knee ROM were set from 0º to 90º knee flexion so that the knee was extended from approximately 90º flexion to full knee extension. This ROM was selected to include the ROM where most functional knee activities occur such as sitting, standing, and walking (Doucette & Child, 1996).

Treatment procedure:

Each patient in both groups received 9-12 sessions (3-4 sessions per week for 3weeks) of hip strengthening exercises in group (A) and knee program exercises for group (B). Each strengthening exercise was performed for 3 sets of 10 repetitions with 3 sec rest between repetitions and 1 minute rest after each set. Each patient was trained at 60% of 10-repetition maximum(the amount of weight that was lifted and lowered through available range of motion exactly 10 times) [30]. To determine the 10-repetition maximum, the therapist selected a specific amount of resistance and document how many repetitions can be completed through the full range before the muscle begin to fatigue. A new 10 repetition maximum was established at the end of each week of training[30].

Hip strengthening exercises for hip abductors and external rotators[31,32] : While lying on the nonaffected side, the pateint was asked to bend the knee of nonaffected side and extend the affected knee,while the therapist stabilizing the pelvis. A sandbag was wrapped just proximal to lateral malleolus and the patient was asked to raise his limb in abduction, hold for 6 sec count, then lowering his limb slowly through 6 sec and return to starting position and relax[31,32].

Hip external rotation strengthening exercise: The patient was sitting at the edge of the bed with the hip and knee joints flexed to 90 degree, and his hand behind him for support, while the therapist was stabilizing the patient’s thigh. Sandbag was wrapped just proximal to lateral malleolus, then the patient was asked to rotate the leg inward toward the nonaffected side, hold for 6 sec count, then return to starting position slowly through 6 sec and relax[31,32].

Knee exercises program**:** The exercise protocol included strengtning and stretching exercises[33,34]. Strengthening exercises program included straight leg raisings exercise. In this exercise the patient laid supine with the knee in zero degree of flexion and the uninvolved leg was 90° of flexion.

Sandbag was wrapped just proximal to the ankle joint**,** the patient was asked to contract the quadriceps and lift the involved leg up to the level of uninvolved knee as much as possible then hold for 6 sec count, then return to starting position slowly through 6 sec and relax[33,34].

Terminal knee extension exercise **(**short arc movements from 15° of knee flexion to terminal extension): While the patient lying supine lying position with both knees fully extended,, the therapist placed a rolled up towel under the involved knee. Sandbag was wrapped just proximal to the ankle joint. The patient was asked to lift the involved foot up by straightening the knee as far as possible (still supported by the roll) and hold for 6 sec count, then return to starting position slowly through 6 sec and relax[33,34].

Stretching exercises program (for quadriceps, hamstring, iliotibialband and gastrocnemius)[30, 34]:

For hamstring stretching exercise, the patient laid supine, with the knee fully extended. The patient's leg was supported over the therapist's arm or shoulder**.** The therapist stabilized the patient's opposite extremity along the anterior aspect of the thigh by a belt. This position was maintained for 30 sec then release with 3 times repetition and rest for 10 sec between each repetition.

Quadriceps stretching exercise:The patient laid side lying on the nonaffected limb, the therapist stood behind the patient while grasping the flexed knee, and the pelvis was stabilized by the other therapist's hand**.** The therapist pulled the limb backward, and held this position for 30 sec then release with 3 times repetition and rest for 10 sec between each repetition[30, 34].

Iliotibial band stretching exercise: The patient assuming the previous position. The therapist stabilized the pelvis by one hand and the other hand adduct the upper-most limb cross the other limb. For all stretching exercises, the stretch position was maintained for 30 sec and repeated 3 times with a rest period of 10 seconds between each two repitition[30, 34].

Gastrocnemius stretching exercise: From patient supine lying position, the therapist stood at the affected side with one hand fixing the leg and the other hand cupping the patient heel. The therapist applied a stretch force by his hand, and maintained this position for 30 sec then release with 3 times repetition and rest for 10 sec between each repetition[30, 34].

Statistical analysis

All statistical measures were performed using the Statistical Package for Social science (SPSS) program version 18 for windows. Prior to final analysis, data were screened for normality assumption, and presence of extreme scores. This exploration was done as a pre-requisite for parametric calculation of the analysis of difference and analysis of relationship measures. To determine similarity between the groups at base line, subject age, height, BMI and body weight were compared using independent t tests.

2x3 Mixed Design MANOVA was conducted to compare PT (Nm) values of the hip abductors and external rotators, knee extensors, Q angle, anteversionangle , VAS, and AKPS among different training periods for group (A) and group (B). In addition, it was conducted to compare between group (A) and group (B) for the tested dependent variables in the different training periods. This design involved two independent variables. The first one was the (tested group); between subject factor which had two levels (Group A and Group B). The second one was the (training periods); within subject factor which had three levels (pre, post three weeks, and post six weeks). In addition, this test involved seven tested dependent variables (eccentric torques of hip abductors, external rotators, and knee extensors, VAS, AKPS, Q angle, and anteversion angle). Accordingly, 2×3 Mixed design MANOVA was used to compare the tested variables of interest at different tested groups and training periods. The alpha level was set at 0.05.

RESULTS

Baseline and demographic data

There were no statistically significant differences (P >0.05) between subjects in both groups concerning age, weight, height, and BMI (Table 1).

Table 1: Descriptive statistics and unpaired t-tests for the mean age, weight, height, and BMI of the patients with patellofemoral pain syndrome for both groups.

	Age (years)	Weight (kg)	Height (cm)	BMI (kg/m²)
Group (A)	23.33±5.39	71.16±13.05	164.75±4.5	26.21±4.71
Group (B)	23.16±6.33	69.41±18.14	164.66±7.27	25.2±6.2
t-value	0.186	0.391	0.034	0.446
p-value	0.854	0.699	0.973	0.660

Statistical analysis revealed that there were significant within subject effect (F = 12.741, p = 0.000) and treatment*time effect (F= 3.135, p = 0.045) but there were no significant between subject effect (F = 0.623, p = **0.73**). The descriptive statistics showed increasing in the mean peak torque values of hip abductors and external rotators, knee extensors, and in AKPS score in both groups at 3 and 6 weeks post tests. Moreover, there were a decreasing in the Q angle, femoral anteversion angle, and level of pain in both groups 3 ad 6 weeks post tests (Table 2 and 3).

Table 2.

Descriptive statistics for the isokinetic PT values (Nm) of the hip abductors, external rotators and knee extensors in the eccentric mode of muscle contraction at angular velocities 60°/sec and 90°/sec respectively for both groups at differenttraining periods.

Isokinetic PT (Nm)	Group A			Group B		
	Pre	Post 3 weeks	Post 6 weeks	Pre	Post 3 weeks	Post 6 weeks
Hip abductors PT (Nm)	44.08±13.96	61.16±19.9	63.5±23.99	49.91±18.25	64.25±21.8	76.33±30.33
Hip external rotators PT (Nm)	25±5.18	29.91±4.9	32.58±8.08	31.08±11.88	32±10.19	34.08±9.66
Knee extensors PT (Nm)	39.41±6.9	49.25±18.31	55.25±29.21	42.75±13.32	45.08±9.92	61.16±32.92

Table 3.

Descriptive statistics for the Q angle, femoral anteversion angle (FAA), VAS and AKPS for both groups at differenttraining periods.

Dependent variables	Group A			Group B		
	Pre	Post 3 weeks	Post 6 weeks	Pre	Post 3 weeks	Post 6 weeks
Q angle	20.64±3.726	15.29±1.68	15.2±1.43	20.11±4.57	18.1±3.98	15.13±2.09
FAA	18.33±5.04	14.5±3	14.4±2.7	19.35±2.96	17.57±2.65	13.97±1.13
VAS	6.5±1.97	3.83±2.03	0.633±0.88	6.87±1.38	3.41±1.72	2.2±1.69
AKPS	69.83±9.85	84.16±7.75	94.75±5.27	68.16±13.8	82.41±10.58	86.41±10.58

Multiple pairwise comparison tests (Post hoc tests) revealed that there were significant increase in the mean value of the hip abductors' PT between (pre versus post 3 weeks and pre versus post 6 weeks) ($p<0.05$) and insignificant between (post 3 weeks versus post 6 weeks) ($p>0.05$) in group (A). In addition, there were significant increase in the mean value of the hip abductors' PT among training periods (pre versus post 3 weeks, pre versus 6 weeks and post 3 weeks versus post 6 weeks) ($p<0.05$) in group (B) (Table 4).

Also, there were significant increase in the mean value of the hip external rotators' PT between pre test and post 6 weeks and insignificant differences between (pre test and post 3 weeks and post 3 weeks and post 6 weeks) at group (A). In addition, there were no significant differences in the mean value of the hip external rotators' PT among the training periods at group (B). Also, there were no significant differences in the mean value of the knee extensors' PT among the training periods in both groups ($p>0.05$) (Table 4). Regarding between subject effects multiple pairwise comparison tests (Post hoc tests) revealed that there were no significant differences in the mean values of the hip abductors' and external rotators' and knee

Table 4.

Multiple pairwise comparison tests (Post hoc tests) for hip abductors, external rotators, and knee extensors PT strength at different training periods for both groups.

Multiple pairwise comparison tests (post hoc tests) for hip abductors, external rotators, and knee extensors PT strength at different training periods for both groups

	Group A			Group B		
	Hip abductors	Hip external rotators	Knee extensors	Hip abductors	Hip external rotators	Knee extensors
Pre Vs. post 3 weeks	0.013*	0.165	0.12	0.042*	1.00	1.00
Pre Vs. post 6 weeks	0.007*	0.004*	0.178	0.000*	0.475	0.091
Post 3 weeks Vs. post 6 weeks	1.00	0.267	1.00	0.011*	0.530	0.07

	Pre			Post 3 weeks			Post 6 weeks		
Group A Vs. B	Hip Abd.	Hip Ext. Rot.	Knee Ext.	Hip Abd.	Hip Ext. Rot.	Knee Ext.	Hip Abd.	Hip Ext. Rot.	Knee Ext.
P- value	0.389	0.118	0.450	0.722	0.530	0.496	0.263	0.713	0.646

Abd: abduction, Ext. Rot: external rotation, Ext: extensors.
*Significant at alpha level <0.05

Multiple pairwise comparison tests (Post hoc tests) revealed that there were significant reduction in the mean value of the Q angle between (pre versus post 3 weeks and pre versus 6 weeks) ($p<0.05$) and insignificant between (post 3 weeks versus post 6 weeks) ($p>0.05$) in group (A). In addition, there were significant reduction in the mean value of the Q angle among training periods ($p<0.05$) in group (B). Also, there were significant reduction in the mean value of the femoral anteversion angle between (pre versus post 3 weeks and pre versus post 6 weeks) ($p<0.05$) and insignificant between (post 3 weeks versus post 6 weeks) ($p>0.05$) in group (A). In addition, there were significant reduction in the mean value of the femoral anteversion angle between (pre versus post 6 weeks and post 3 weeks versus post 6 weeks) ($p<0.05$) and insignificant between (pre versus post 3 weeks) ($p>0.05$) in group (B). Additionally, there were significant reduction in the mean value of the VAS scale among training periods ($p<0.05$) in group (A).

As well, there were significant reduction in the mean value of the VAS scale between (pre versus post 3 weeks and pre versus 6 weeks) ($p<0.05$) and insignificant between (post 3 weeks versus post 6 weeks) ($p>0.05$) in group (B). Moreover, there were significant increase in the mean value of the AKPS score among training periods ($p<0.05$) in group (A). Also, there were significant increase in the mean value of the AKPS score between (pre versus post 3 weeks and pre versus 6 weeks) ($p<0.05$) and insignificant between (post 3 weeks versus post 6 weeks) ($p>0.05$) in group (B) (Table 5). Regarding between subject effects multiple pairwise comparisons revealed that the mean values of the Q angle and femoral anteversion angle declined significantly in group (A) at post 3 weeks compared with group (B) ($p<0.05$). In addition, the mean values of the VAS scale declined significantly in the group (A) at post 6 weeks compared with group (B) ($p<0.05$) and the mean values of the AKPS score improved significantly in the group (A) at post 6 weeks compared with the group (B) ($p<0.05$) (Table 5).

Table 5.

Multiple pairwise comparison tests (Post hoc tests) for Q angle, femoral anteversion angle (FAA), VAS and AKPS at different training periods.

Multiple pairwise comparison tests (post hoc tests) for Q angle, femoral anteversion angle (FAA), VAS, and AKPS at different training periods for both groups

	Group A				Group B			
	Q angle	FAA	VAS	AKPS	Q angle	FAA	VAS	AKPS
Pre Vs. post 3 weeks	0.000*	0.000*	0.000*	0.000*	0.015*	0.05	0.000*	0.000*
Pre Vs. post 6 weeks	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
Post 3 weeks Vs. post 6 weeks	1.00	1.00	0.000*	0.000*	0.000*	0.000*	0.132	0.258

	Pre				Post 3 weeks				Post 6 weeks			
Group A Vs. B	Q angle	FAA	VAS	AKPS	Q angle	FAA	VAS	AKPS	Q angle	FAA	VAS	AKPS
P-value	0.76	0.55	0.59	0.73	0.03*	0.01 *	0.59	0.64	0.91	0.61	0.00*	0.02*

***Significant at alpha level <0.05**

DISCUSSION

It was previously reported that weakness of the hip musculature could lead to increase femoral adduction, medial rotation, anteversion angle, and Q angle during dynamic weight-bearing activities, which would increase the lateral patellofemoral joint vector, leading to patellar facet overload [38]. The findings of the present study support the growing body of literature which suggest that hip strengthening may be a viable intervention for PFP. An explanation to this finding is that, proximal lower extremity strength is believed to be vital for control of hip joint position and the resultant alignment of the distal segments[38]. During athletic performance, the hip musculature provides a protective mechanism through its influence on lower extremity alignment. For example, weakness of the iliopsoas and the posterior fibers of the gluteus medius may place the femur in a more medially rotated position, allowing for abnormal movement of the patella within the trochlear groove and increasing susceptibility to PFPS[40].

The findings of this study showed that patients with PFPS who received hip abductors and external rotators strength program had significant lower Q angle and anteversion angle compared to patients who received knee exercises. These finding were supported by several authors[23,35,36] who recommended addition of hip abductors and lateral rotators strengthening to the rehabilitation program for patients with PFPS. The importance of hip abductor and lateral rotator muscles strengthening in the treatment of PFPS is based on several studies that have demonstrated weakness of the hip abductors and lateral rotators in patients with PFPS[16,22,37].

The current study reported a decrease in pain and improvement in knee function (though non significant) in both group. This result is somehow similar to the results of a study conducted by Razeghi et al[23] who found that the maximum improvement of pain and function activities occurs in participants, who received the hip strengthening exercise in addition to traditional exercise program. Also, Khayambashi et al.,[24] examined the effectiveness of isolated hip abductor and external rotator strengthening on pain, health status, and hip strength in females with patellofemoral pain (PFP). Twenty-eight females with PFP were sequentially assigned to an exercise (n = 14) or a no-exercise control group (n = 14). The exercise group completed bilateral hip abductor and external rotator strengthening 3 times per week for 8 weeks. Pain (visual analog scale), health status, and hip strength (handheld dynamometer) were assessed at baseline and post intervention. Pain and health status were also evaluated at 6 months post intervention in the exercise group. The authors revealed that there was significant group-by-time interactions for each variable of interest. Post hoc testing revealed that pain, health status, and bilateral hip strength improved in the exercise group following the 8-week intervention but did not change in the control group. Improvements in pain and health status were sustained at 6-month follow-up in the exercise group. The authors concluded that a program of isolated hip abductor and external rotator strengthening was effective in improving pain and health status in females with PFP compared to a no-exercise control group. The incorporation of hip-strengthening exercises should be considered when designing a rehabilitation program for females with PFP.

Additionally Dolak et al[41]confirm the results of present study as they reported that the patients who started with hip strengthening reported an earlier and more significant drop in knee pain after only 4 weeks of rehabilitation, while the patients who initially performed quadriceps strengthening required 8 weeks of rehabilitation to achieve a similar decrease in pain. So both rehabilitation approaches led to improvements in self-reported function, pain, and hip strength, but treatment of PFPS, targeting hip strengthening initially may be more efficient, allowing for muscle training while reducing exacerbation of patellofemoral symptoms.

On the other hand Fukuda et al[36] found no significant difference in function activities improvement between the patients received strength exercise for hip muscles in addition to traditional exercise program and patients received traditional exercise program only, however there was significant improvement in pain. Also, Khayambashi et al[46] evaluated the efficacy of posterolateral hip muscle strengthening versus quadriceps strengthening in reducing pain and improving health status in persons with patellofemoral pain (PFP). Patients were alternately assigned to a posterolateral hip muscle strengthening group (9 men and 9 women) or a quadriceps strengthening group (9 men and 9 women). The posterolateral hip muscle strengthening group performed hip abductor and external rotator strengthening exercises, whereas the quadriceps strengthening group performed quadriceps strengthening exercises (3 times a week for 8 weeks).Pain (visual analog scale) and health status were assessed at baseline, post intervention, and 6-month follow-up. The authors revealed that there was significant improvements in VAS and health status in both groups from baseline to post intervention and baseline to 6-month follow-up. Improvements in VAS and health status in the posterolateral hip exercise group were superior to those in the quadriceps exercise group post intervention and at 6-month follow-up. The authors concluded that although both intervention programs resulted in decreased pain and improved function in persons with PFP, outcomes in the posterolateral hip exercise group were superior to the quadriceps exercise group. The superior outcomes obtained in the posterolateral hip exercise group were maintained 6 months post intervention.

In the study by Nakagawa et al[35] the results of the pain assessment were obtained using visual analogue scales, the intervention group showed a significant improvement in pain. The result of this study are also supported by many researchers**.**Tyler et al[7] results confirmed those of Mascal et al[42] who said that for more improve of pain and function activities of patients with PFPS should adding strengthening to hip abductor, lateral rotator muscles to traditional exercise program. Other similar studies supported these effect, like of those of Boling et al[43],andEarl &Hoch[44].

Mascal et al[42] reported pain symptom and function improvement after 14 weeks of treatment associated with increases in the gluteus medius and gluteus maximus isometric muscle force production and improved motor control of hip motion during functional weight-bearing activities. Based on the findings of Mascal et al[42] it is reasonable to suggest that improvements in hip abduction and external rotation strength, which ranged from 32% to 56%, might have resulted in changes in hip kinematics during functional activities. Given that excessive hip adduction and internal rotation have been postulated to adversely affect patellofemoral joint kinematics and kinetics[45], it is possible that the changes in hip muscle performance might have resulted in a decrease in patellofemoral joint loading and, therefore, pain. However, care must be taken in attributing changes in patellofemoral symptoms to improved hip kinematics after strengthening in isolation, as recent research suggests that changes in hip kinematics may be more related to skill acquisition (skilled practice) as opposed to improvements in hip strength. There are several limitations of our study. First, small sample size may limited generalization but we recruited 12 pateints in each group based on previously published data[24] to detect difference in pain and functional scale with power analysis 80 % and at alpha level of 0.05. second, we did not assess the long term effect of the isolated hip strengthening exercises and isolated knee strengthening and stretching exercises on pain, kujala score, Q angle and anteversion angle. A third limitation was the absence of control group of PFPS patients who received no treatment as the author did not want to leave pateints untreated through this period of time. Further research should include a greater sample size and a follow-up period.

CONCLUSION

Hip strengthening exercises are more effective than knee strengthening exercises in reducing Q-angle and anteversion angle. Consequently, this may help physiotherapists in designing the most effective and efficient prevention and rehabilitation programs for patients suffering from PFPS.

Implication

The incorporation of hip strengthening exercises should be considering when desiging a rehabilitation program for pateints with patellofemoral pain syndrom.

Author contributions

Author (1) contributed in the conception and design of the study, collection and assembly of data, analysis and interpretation of data, writing the manuscript, conducting exercises program and final approval of the article. Author (2) contributed in the conception and design of the study, analysis and interpretation of data, critical revision of the article and screening the patients for inclusion and exclusion criteria. Author (3) contributed in acquisition of data, critical revision of the article, reporting outcome measures, and conducting statistical analysis. Authors (4) contributed in the conception and design of the study, analysis and interpretation of data, critical revision, correcting and revising manuscript, sampling selection and screening, and final approval of the article.

Conflict of interest

The authors declare that they have no conflicts of interest.

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Effect of Core Stability Exercises on Trunk Muscle time to Peak Torque in Healthy Adults

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Type of Participation: Poster.

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Correlation Study between Clinical and Radiological Findings in Knee Osteoarthritis

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Abstract

Background: Osteoarthritis (OA) of the knee is the most common form of arthritis and leads to more activity limitations (e.g., disability in walking and stair climbing) than any other disease, especially in the elderly. Recently, impaired proprioceptive accuracy of the knee has been proposed as a local factor in the onset and progression of radiographic knee OA (ROA). Purpose: To compare between the clinical and radiological findings in healthy with that of knee OA. Also, to determine if there is a correlation between the clinical and radiological findings in patients with knee OA. Subjects: Fifty one patients diagnosed as unilateral or bilateral knee OA with age ranged between 35-70 years, from both gender without any previous history of knee trauma or surgery, and twenty one normal subjects with age ranged from 35 - 68 years. Methods: Peak torque/body weight (PT/BW) was recorded from knee extensors at isokinetic isometric mode at angle of 45 degree. Also the absolute angular error was recorded at 45O and 30O to measure joint position sense (JPS). They made anteroposterior (AP) plain X rays from standing semiflexed knee position and their average score of timed Up and Go test(TUG) and WOMAC were recorded as a measure of knee pain, stiffness and function.Comparison between the mean values of different variables in the two groups was performed using unpaired student t test. P value less or equal to 0.05 was considered significant. Results: There were significant differences between the studied variables between the experimental and control groups except the values of AAE at 30O. Also there were no significant correlation between the clinical findings (pain,function,musclestrength and proprioception) and the severity of arthritic changes in X rays Conclusion: From the finding of the current study we can conclude that there were a significant difference between the both groups in all studied parameters (the WOMAC ,functional level, quadriceps muscle strength and the joint proprioception). Also this study did not support the dependency on radiological findings in management of knee OA as the radiological features did not necessarily indicate the level of structural damage of patients with knee OA and we should consider the clinical features in our treatment plan.
Keywords: joint position sense, peak torque, proprioception, radiological knee osteoarthritis

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Relationship between Chronic Mechanical Low Back Pain and Hip Rotation

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Type of Participation: Research Study.

Abstract—Chronic mechanical low back pain (CMLBP) is the most common complaint of the working-age population. The purpose of this study was to investigate if there a relationship between chronic mechanical low back pain (CMLBP) and hip medial and lateral rotation (peak torque and Range of motion(ROM) in patients with CMLBP.SUBJECTS AND METHODS , sixty patients with CMLBP Visual Analogue Scale (VAS) was used to assess pain . Fluid Filled Inclinometer was used to measure Hip rotation ROM (medial and lateral). Isokinetic Dynamometer was used to measure peak torque of hip rotators muscles (medial and lateral), concentric peak torque with low Isokinetic speed (60 /sec) was selected to measure peak torque .RESULTS, The results of this study demonstrated that there is poor relationship between pain and hip external rotation ROM, also there is poor relation between pain and hip internal rotation ROM. There is poor relation between pain and hip internal rotators peak torque and hip external rotators peak torque .CONCLUSIONS: SO, depending on the current study it is not recommended to give an importance to hip rotation in treating Chronic Mechanical Low Back Pain . *Keywords—Hip rotation ROM, Hip rotators strength, Low Back Pain.*

INTRODUCTION

Mechanical Low Back Pain (MLBP) is a major cause of illness and disability, especially in people of working age. By definition, it excludes pain resulting from neoplasia, fracture or inflammatory arthropathy, or that is referred from anatomical sites outside the spine, and in most cases there is no clearly demonstrable underlying pathology [11].

However, when defined by symptoms alone mechanical LBP may not be etiologically homogeneous. Although the pathogenesis is generally unclear, structural abnormalities of the spine do account for the symptom in some cases. It could be, for example, that for LBP associated with identifiable underlying spinal pathology, physical MA. D. Mohamed is with Department of Physical Therapy For Muscloskeletal Disorders And Their Surgery, Faculty of Physical Therapy, Cairo University,(dr.mahmoud_diab@yahoo.com).

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risk factors are relatively more important, while psychological risk factors have less impact [1].

This type of pain is often due to stress or strain to the back muscles; tendons, and ligaments and is usually attributed to strenuous daily activities, heavy lifting, or prolonged standing or sitting.

Mechanical low back pain is often a chronic, dull, aching pain of varying intensity that affects the lower spine and might spread to the buttocks. The pain often progressively worsens during the day because of daily physical activities such as bending, twisting, and lifting. Prolonged sitting and standing often aggravate the pain. There are no associated neurological symptoms or signs [9].

The hip joint serves as a central pivot point for the body as a whole. This large ball-and socket joint allows simultaneous, triplanar movements of the femur relative to the pelvis, as well as the trunk and pelvis relative to the femur. Lifting the foot off the ground, reaching towards the floor, or rapidly rotating the trunk and pelvis
while supporting the body over one limb typically demands strong and specific activation of the hips' surrounding musculature [10].

Pathology that affects the strength, control, or extensibility of the hip muscles can significantly disrupt the fluidity, comfort, and metabolic efficiency of many routine movements involving both functional and recreational activities [10].

Physical therapy diagnosis related to the hip and adjacent regions often requires a solid understanding of the actions of the surrounding muscles. This knowledge is instrumental in identifying when a specific muscle or muscle group is weak, painful, dominant, or tight (ie, lacks the extensibility to permit normal range of motion).

Depending on the particular muscle, any one of these conditions can significantly affect the alignment across the lumbar spine, pelvis, and femur, ultimately affecting the alignment throughout the entire lower limb [10].

Because of the anatomic proximity and interconnections of the hip joint and lumbopelvic region, , a number of investigators have focused on the relationship between hip mobility and low back pain (LBP) [4,8,15].The interest in the hip-LBP relationship is based on the proposal that limited hip motion will be compensated by motion in the lumbopelvic region. The proposed result is (1) an increase in the frequency of lumbopelvic motion with hip motion, (2) low magnitude loading in the lumbar region, (3) accumulation of tissue stress, and eventually (4) LBP symptoms [16,17].

There have been a growing number of studies that suggest that asymmetryin hip rotation, where external rotation (ER) exceeds internal rotation (IR) or where IR exceeds ER are related to a number of different lower extremity musculoskeletal problems that clinicians often see [4].

Hip rotation asymmetry is often found in many different musculoskeletal conditions that affect the low back, hip, and knee [5]**.**

The results of their study lend further support to the importance **of** assessing hip rotation asymmetry when treating patients with low back, hip, or knee Pain [4].

To our knowledge, the relationship between MLBP assessed by VAS and peak torque of hip rotators assessed by Isokinetic dynamometer up till now has not been examined in people with mechanical LBP.

Aim of the study:

The purpose of this study is to detect if there is a relationship between mechanical low back pain and torque of hip lateral and medial rotators and to detect if there is a relationship between mechanical low back pain and ROM of hip lateral and medial rotation.

II. Materials and Methods:

Subjects:

The study was conducted on 60 patients (53male and 7 female) referred from an orthopedist with the diagnosis of mechanical low back pain, their age ranged from 20-30 years with mean of age (23.76±2.39) years, mean weight (71.8±12.7) (Kg), mean height (169.65±7.49) (Cm) and mean BMI (25.5±3.86) (Kg/m2). We measured muscle torque by isokinetic dynamometer.

Subjects were included in this study if they suffer from mechanical low back pain, their age ranged from 20 to 30 years and their pain from at least three months ago. All subjects were asked to assign a consent form approved from ethical committee of faculty of physical therapy of Cairo university. This study was conducted in the lab of isokinetic of the faculty of physical therapy, Cairo University.

Patients were excluded if they had one of the following: lumber disc prolapsed, lumber spondylosis, Spinal stenosis, sponylolisthesis, spondylolysis, ankylosing spondylitis and Spinal instability lower limb injury (surgery or leg-length discrepancy), knee or hip osteoarthritis fracture of vertebral column or history of spinal surgery kyphosis or scoliosis, Rheumatoid arthritis.and sacroiliac joint dysfunction.

Our patients were at working age, some of them were office worker, some were graduated students of physical therapy at training year and others were workers.

Instrumentations:

Biodex system 3 isokinetic dynamometer (Biodex Medical Systems, Shirley, New York, USA)

The apparatus consists of a dynamometer, a chair, and a control panel.

The position of the dynamometer can be controlled; it can be rotated horizontally, tilted and its height can be adjusted according to the test or rehabilitation procedure as described by the manufacturer's guide. Similarly, the chair position and height can be adjusted. The position and the tilting of the back seat can also be controlled.

The dynamometer can be controlled through the control panel or the computer software (Biodex Advantage Software). Using the panel control, the operator should set the mode (isokinetic, passive, isotonic concentric or eccentric) and the range of motion. Using the computer program, patient's data are first entered, and then the testing or rehabilitation protocol and range of motion are set. A report can be obtained, saved and printed out if desired. The main outcomes documented are: the peak torque, the average peak torque, total work, average power, and agonist/antagonist ratio.

2. The Fluid Filled Inclinometer

3.Scale for measuring pain intensity (Appendix II).

Pain intensity was measured by means of visual analogue scale (VAS)(Fig 3). A 10 cm line marked with numbers 0 to 10 was used where 0 symbolized no pain and 10 was maximum pain. Patient asked to mark this pain on this line as per the severity.

Evaluation procedure

Patients had received full explanation of assessment and treatment procedures, and all procedure was performed after they signed written informed consent form.

Hip medial and lateral rotators torque assessment:

All patients were assessed bilateral hip external and internal rotators torque using an isokinetic dynamometer (Biodex Medical Systems 3). All strength testing were performed at 60º/sec (low speed). Calibration of the dynamometer was carried out before the measurements. Before testing, participants were provided with detailed instructions for the strength testing procedures. Five maximal repetitions for hip external and internal rotation were performed for each strength test A protocol (hip external and internal rotators)for testing was set and saved on the software of the isokinetic apparatus prior to the study, unilateral isokinetic mode, contraction type(concentric/concentric), 60º/sec velocity.

The patient's weight and height were measured and recorded.

Patient's personal data were entered to the "patient" section of the software and saved.

The positions of the seat and the dynamometer was adjusted for easuring hip joint for rotators. Dynamometer orientation 0º, dynamometer tilt 0°, seat orientation 90°, and seatback tilt 85º. The attachment of the hip (of the involved side) was attached to the dynamometer (Biodex system 3 pro manual).

The patient sat on the chair of the apparatus with the hip and knee flexed to 90° (fig. 1), the axis of rotation for the dynamometer was aligned with the long axis of the femur, and the seat height and position will be adjusted for accurate alignment.

The hip attachment was adjusted to be proximal to the patient's lateral malleolus then secured by its strap. Shoulder and thigh stabilization straps were fastened (Biodex system 3 pro manual).

The dynamometer ROM was set, with 30ºexternal rotation away (Fig 1) and 30º internal toward (Fig 2). (concentric away and concentric toward), the anatomical position of the patient was calibrated, and the patient's limb weight was measured, neutral position was used as starting position. After two trial repetitions, the test was conducted.

The patient was verbally encouraged to maintain muscle contraction through the seated ROM, patients taking visual and auditory feedback from apparatus, and not stop the movement (if patient movement stops, resistance stops) using verbal command as push.

The patient performed 5 repetitions of concentric contraction (medial and lateral hip rotation).The largest number of (peak torque) readings will be documented and was used in comparison between variables. All peak torque data (Nm) was normalized to body mass index (Nm/kg/m2).

Fig.(1) Hip rotation strength test for RT hip internal rotators test

Fig .(2)Hip rotation strength test for RT hip external rotators test

2. Procedure of measurement of hip rotation ROM:

All subjects were required to wear non restrictiveclothes and, prior to the test the joint was moved through its full range of motion.

Measurements were taken place with the subject in the prone position chosen rather than supine as it has been shown to be more reliable.

The participant's arms were positioned at his sides and his head was turned to the side that was most comfortable (Fig7).

In order to localize the measure to the hip joint the pelvis wasstabilized with a belt at the level of the posterior inferior iliac spines. The measured hip was placed in 0 degree of abduction and knee flexed to 90(fig.3). The contra lateral hip was abducted to 30 degree (Fig 4).

Fig. (3): Starting position for RT hip rotation ROM measurement

To familiarize the participant with the procedures and to assure them that the lower extremity movements were free, the lower extremity to be ested was passively moved once into medial rotation and once into lateral rotation.

The start position for testing passive hip rotation then was achieved by positioning the tibia plateau of the tested leg parallel to the support surface. After zeroing the inclinometer to a fixed vertical reference, the Inclinometer was positioned just below lateral malleolus and the starting position was measured. The leg was then passively moved to produce medial (Fig.3) and lateral (Fig.4)rotation with the range of movement (ROM) being recorded to the nearest degree at the point of resistance.

Fig.(4) End position of RT hip external rotation ROM measurement

Final passive ROM was decided when resistance was met or compensatory movement at the pelvis became evident.ROM was obtained for both right and left. Passive range of motion was calculated as the difference between the final and initial position of the lower leg average the across the three trials. The first limb to be tested and the direction of rotation (medial, lateral) Total medial and lateral hip rotation was defined as the sum of both left and right measurement. Three measurements were taken for each maneuver and a mean was obtained.

III. Results

In this study, 60 patients with mechanical low back pain were participated in this study. The data in table (1) represented their mean age (23.76±2.39) years, mean weight (71.8±12.7) kilograms (Kg), mean height (169.65±7.49) (Cm) and mean BMI (25.5±3.86) (Kg/m2).

Table (1): Physical characteristics of patients

Items	Mean	±SD
Age (yrs)	23.76	±2.39
Weight (Kg)	71.8	±12.7
Height (Cm)	169.65	±7.49
BMI (Kg/m2)	25.5	±3.86

We compare between both variables (internal and external muscle peak torque) using mean values and then we use paired t-test to assess the significance of difference between variables and we used person correlation coefficient to relate between variables.

1. Pain intensity (VAS) and total hip internal rotation ROM:

There was no significant correlation between Pain intensity (VAS) and Total hip internal rotation ROM as shown in Table (2).

Table (2): Correlation Analysis between (VAS) and ROM..

correlation coefficient	correlation coefficient
R-value	-0.05

P-value	0.68

*R-value: correlation coefficient, P-value: probability.

2. Pain intensity (VAS) and total hip external rotation ROM:
There was no significant correlation between Pain intensity (VAS) and Total hip external rotation ROM as shown in Table (3) .

Table (3): Correlation Analysis between (VAS) and ROM.

correlation coefficient	correlation coefficient
R-value	-0.07
P-value	0.57

3.pain intensity (VAS) and l total hip internal rotation torque/ BMI:
There was no significant correlation between Pain intensity (VAS) and Low speed total hip internal rotation torque as shown in Table (4) .

Table (4): Correlation Analysis between (VAS) and torque/BMI.

correlation coefficient	correlation coefficient
R-value	-0.03
P-value	0.76

4.Pain intensity (VAS) total hip external rotation torque/ BMI:
There was no significant correlation between Pain intensity (VAS) and Low speed total hip external rotation torque as shown in Table (5) .

Table (5): Correlation Analysis between (VAS) and torque/BMI.

correlation coefficient	correlation coefficient
R-value	-0.02
P-value	0.86

IV. Discussion

Chronic mechanical low back pain (CMLBP) is the most common complaint of the working-age population. In addition to human suffering, it causes a substantial economic burden due to the wide use of medical services and absence from work. Imbalance between hip internal and external rotators muscles may be a contributing factor for low back pain.
We summed right and left rotation ROM to be the total rotation ROM and total rotation peak torque equals the sum of both RT and LT Rotation peak torque. This procedure similar to reference [5,15].

1.Relationship between CMLBP and hip rotation ROM Statistical analysis revealed that there was poor inverse correlation between pain intensity and total hip internal rotation ROM and there was poor inverse correlation between pain intensity (VAS) and total hip external ROM.

Those results were in agreement with reference [14]which found that there was no relationship between low back pain and movement of the hip in horizontal plane. It could be due to twisting movement in trunk mainly achieved by movements of the hips with small amount of movement of the lumbar spine Our finding agree with reference [8] which examined hip mobility in 476 patients with recurrent LBP and stated that there is no significant correlation between LBP and hip external oration ROM,

but his results revealed significant negative relation between LBP and hip internal rotation and this results against our finding ,It may be due to Clinical characteristics of his participants were different as mean age of his participants was 44 years old which higher than our participants which was 23 years and that might be related to the severity or progression of LBP.

In reference [5] who examined patients with unspecified LBP and concluded a significant relationship between low back pain and limited hip rotation ROM .Their results could not be compared with ours since the clinical characteristics of their subjects were different from ours .As he selected the patients with canal stenosis and disc herniation and sacroiliac dysfunction with age ranged from 23 to 61 years whom we excluded in our study.

Also, reference [15] investigated the relationship between LBP and passive hip rotation motion in forty-eight subjects (35 males, 13 females) .The results is in contradiction with the result of our study and it may be due to the clinical history and characteristics of the subjects included in the study, the participants reported regular participation in a sport that placed repetitive rotational demands on the hip and the lumbopelvic region.

2. Relatioship between CMLBP and hip rotators torque .

Statistical analysis revealed that there was poor inverse correlation between pain intensity and low speed total hip internal rotators peak torque, and there was poor inverse correlation between pain intensity and low speed total hip external rotators peak torque.

So the results revealed no relationship between pain and hip rotators peak torque (in both speeds of assessment) as those of previous finding between pain and ROM patient with CMLBP.It could be due to limited axial rotation of the spine by natural resistance (stretched apophyseal joint capsule and annulus fibrosis) which provides vertical stability throughout the lower end of the vertebral column.

The well-developed lumbar multifidi muscles and relatively rigid sacroiliac joints reinforce this stability [10].

And as we mentioned before the poor relationship between peak torque /BMI and CMLBP could be due to small age of the patients and the lower need for greater hip rotation and it may get worth by aging.

We assessed the relationship between LBP and hip rotation ROM and peak torque by using 60 adult male and female patients suffering from MLBP and referred from an orthopedic surgeon and those were strong points in our study, We assessed the Rotation ROM using fluid filled inclinometer and the muscle torque by Isokinetic unit which are validated and reliable tools for assessment. And the points of weakness were that: this is only one group of assessment, lack of a clear way of randomization and most of the subjects were males.

V. Conclusion

It was concluded that there is no relationship between low back pain and hip rotators (peak torque and ROM) in patient with CMLBP .So when the age is small and the need to hip rotation is not higher (not athlete), the patient cannot feel the problem (MLBP) even it exists. So, we recommend caution that the problem doesn't found yet, but it may be exaggerate to patients by growing older or by progress of the conditions or both.

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Association of Quadriceps Torque with Lower Extremity Dysfunction in Women with Early Degrees of Knee Osteoarthritis

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Type of Participation: Research Report - Poster Only.

Abstract

PURPOSE :

The purpose of this study was to investigate whether or not there is an association between concentric and eccentric torque of quadriceps muscle with lower Extremity Dysfunction represented by WOMAC including (pain, knee stiffness and physical function) in women with early stages of knee OA.

ABSTRACT BODY:

PURPOSE :

The purpose of this study was to investigate whether or not there is an association between concentric and eccentric torque of quadriceps muscle with lower Extremity Dysfunction represented by WOMAC including (pain, knee stiffness and physical function) in women with early stages of knee OA.

BACKGROUNDS/SIGNIFICANCE:

Osteoarthritis (OA) is the most common form of arthritis and the incidence is increasing markedly due to an ageing population. Recent observational studies suggest that quadriceps muscle weakness is associated with an elevated risk for incident symptomatic and progressive knee OA. However, few studies have evaluated this associationin a population with early stages of knee OA especially in women.

SUBJECTS:

Forty females patient had participated in this study.With age ranged fromforty to fifty five years represented their mean age (50.05±4.006) years, mean weight (82.13±8.16) (Kg), mean height (158.07±7.25) (Cm) and mean BMI (30.5±4.86) (Kg/m2). With knee OA grades I or II (according to Kellgren and Lawrence criteria).

METHODS AND MATERIALS

The concentric and eccentric quadriceps peak torque were assessed using a Biodex Isokinetic Dynamometer ,Multi-Joint System 3, at a speed of 90°/s. Self-reported symptoms and disability were assessed using the WOMAC questionnairewith each item corresponds to a particular dimension (pain, stiffness and physical function).This questionnaire was translated and validated for Egyptian language.

ANALYSES : Spearman's r correlation coefficients was used to analyze the relationship between the dependent variables (WOMAC subscales for pain, stiffness and physical function) and the independent variables (the normalized mean peak concentric and eccentric quadriceps torques).Significance level set at $p<0.05$ for all comparisons.

RESULTS

The results of this study demonstrated that there is strong negative correlation between the concentric quadriceps torque and pain ($r=-0.68$, $p<0.001$) and physical function ($r=-0.63$, $p=0.011$) Eccentric quadriceps torque presented a moderate and negative correlation with pain and physical function of the two subscales of the WOMAC ($r=-0.50$ to 0.53, $p<0.05$).There is poor inverse correlation between concentric($r=-0.25$, $p=0.11$) and eccentric($r=-0.28$, $p=0.07$). torque of quadriceps and stiffness

CONCLUSIONS

It can be concluded that the concentric and eccentric quadriceps torque is significantly associated with (pain and physical function)in initial stages of knee OA. Also there is no significant association between the concentric and eccentric quadriceps torque and stiffness. Therefore,the strengthening of the quadriceps muscles is indicated in order to minimize pain and physical dysfunction.

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Scientific Conferences 2014

Static lower limb alignment asymmetry in healthy adults
Changes in muscle architecture with various exercises during distraction osteogenesis of tibia
Effects of glenoid labrum removal during latarjet repair on shoulder functional recovery

Aliaa Rehan Youssef

APTA NEXT 2014, 2-16 June 2014.

Type of Participation: 3 studies research.

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Effect of Core Stability Exercises on Trunk Muscle Balance in Healthy Adult Individuals

Amir A. Beltagi

Amira A. A. Abdallah, Amir A. Beltagi**.**

(ICHB) International Conference on Human Biomechanics, Berlin, Germany, 22-23 May 2014

Type of Participation: study research.

***Abstract*—Background:** Core stability training has recently attracted attention for improving muscle balance and optimizing performance in healthy and unhealthy individuals. **Purpose:** This study investigated the effect of beginner's core stability exercises on trunk flexors'/extensors' peak torque ratio and trunk flexors' and extensors' peak torques. **Methods:** Thirty five healthy individuals participated in the study. They were randomly assigned to two groups; experimental "group I, n=20" and control "group II, n=15".

Their mean age, weight and height were 20.7±2.4 vs. 20.3±0.61 years, 66.5±12.1 vs. 68.57±12.2 kg and 166.7±7.8 vs. 164.28 ±7.59 cm. for group I vs. group II. Data were collected using the Biodex Isokinetic system. The participants were tested twice; before and after a 6-week period during which group I performed a core stability training program. **Results:** The 2x2 Mixed Design ANOVA revealed that there were no significant differences ($p>0.025$) in the trunk flexors'/extensors' peak torque ratio between the pre-test and posttest conditions for either group. Moreover, there were no significant differences ($p>0.025$) in the trunk flexion/extension ratios between both groups at either condition.

However, the 2x2 Mixed Design MANOVA revealed significant increases ($p<0.025$) in the trunk flexors' and extensors' peak torques in the post-test condition compared with the pre-test in group I with no significant differences ($p>0.025$) in group II. Moreover, there was a significant increase ($p<0.025$) in the trunk flexors' peak torque only in group I compared with group II in the post-test condition with no significant differences in the other conditions. **Interpretation/Conclusion:** The improvement in muscle performance indicated by the increase in the trunk flexors' and extensors' peak torques in the experimental group recommends including core stability training in the exercise programs that aim to improve muscle performance.

***Keywords* — Core Stability, Isokinetic, Trunk Muscles.**

I. INTRODUCTION

THE spine is an inherently unstable structure as the osteoligamentus lumber spine buckles under small compressive loading. A critical role of the spine musculature is to stiffen the spine in all potential modes of instability.

Active control of spinal stability is achieved through the regulation of force in the surrounding muscles. Trunk extensors, flexors, and lateral flexors provide spinal stability during every dynamic movement. So, there is an important need to have balanced muscular capacity by co-activation of agonistic and antagonistic muscles to maintain this spinal stability [1].

Stability should be started only after achieving good mobility, because adequate muscle length and extensibility are crucial for proper joint function. Also required is a proper relationship between the prime movers, synergists, and stabilizers. Prime movers are the muscles that provide most of the force during a desired body movement. Stabilizers and synergists are muscles that assist in motion by means of controlling or neutralizing forces. Proper timing and coordinated effort of these muscles are important for spinal stability. Muscles that are used frequently can shorten and become dominant in a motor pattern. If a muscle predominates in a motor pattern, its antagonist may become inhibited and cause muscle imbalance [2].

Core stability describes the ability to control the position and movement of the central portion of the body to allow optimum production, transfer and control of force and motion to the terminal segments in the integrated activities. Core stability training targets the muscles deep within the trunk which are connected to the spine, pelvis and shoulders. This training assists in maintaining good posture and provides the foundation for all arm and leg movements [3].

Reference [4] first classified the muscles acting on the lumbosacral spine as either "local" or "global". Scientific modifications have been made to these initial classifications.

The "local" musculature includes the transversus abdominis (TA), multifidi, internal obliques and quadratus lumborum muscles. These muscles have short muscle lengths, attach directly to the vertebrae, and are primarily responsible for generating sufficient force for segmental stability of the spine [5]. Recent research has advocated the TA and multifidi muscles as the primary stabilizers of the spine [6]. The "global" musculature is the rectus abdominis, lateral fibers of the external obliques, psoas major and erector spinae muscles [7]. These muscles are ideal for creating movement of the trunk and producing torque, because of their large moment arms and long levers as they are attached from the thorax to the pelvis [8].

"Exercising core musculature", in its essence, is more than "trunk strengthening". In fact, motor relearning of the inhibited muscles may be more important than strengthening.

Progressive strengthening of the core muscles, particularly the lumbar extensors, may be unsafe to the back. In fact, many traditional back strengthening exercises may also be unsafe.

For example, roman chair exercises or back extensor strengthening machines require at least torso mass as resistance, which is a load, often injurious to the lumbar spine [9]. Traditional sit-ups are also unsafe because they cause increased compressive loads on the lumbar spine [10]. In addition, all these traditional exercises are nonfunctional.

Exercise must progress from training isolated muscles to training integrated systems of muscles to facilitate functional activity [11].

A considered contributing factor to chronic low back pain (CLBP) is poor control of trunk muscles during daily living activities. Core stability exercises are designed to address inter-segmental stability by facilitating neuromuscular control in the lumbar spine [12]. Previous EMG studies have reported changes in spinal muscle recruitment patterns after short and long-term specific core stability interventions in patients with CLBP. Studies on core stability programs have advocated efficient neuromuscular control for trunk stability and accurate trunk muscle recruitment [13].

Previously conducted randomized controlled trials have comprehensively reported the effects of core stability exercises versus conventional physiotherapy treatment regimes on pain characteristics, recurrence and disability scores in patients with CLBP [14]. Despite its clinical popularity, there is limited research work that shows the efficacy of specific spinal stabilization exercises on trunk muscle performance and balance. These types of exercises have strong theoretical appeal, yet more studies are still needed. Assessing trunk muscle balance may help with injury prevention, improving efficiency and performance [2] and augmenting lumbar stability prior to sudden loading [1]. So, the main purpose of this study was to investigate the effect of a beginner's core stability exercise program on trunk muscle balance which is indicated by the peak torque ratio between the trunk flexors and extensors. And consequently, the secondary purpose was to measure the individual trunk flexors' and extensors' peak torques.

II. METHODS

A.Participants

Thirty five healthy college students from the Faculty of Physical Therapy, Cairo University participated in the study.

They were randomly assigned into two groups; experimental (group I) and control (group II). Group I involved 20 participants (10 males & 10 females). Their age, height and weight ranged from 17 to 24 years, 170 to 185cm and 65 to 85 kg respectively. Group II involved 15 participants (6 males & 9 females). Their age, height and weight ranged from 17 to 24 years, 170 to 185cm and 65 to 85kg respectively.

To be included in the study, the participant should have had good abdominal muscle strength of grade four as assessed by manual muscle test. This was determined as having the ability to raise the head and trunk with abdominal muscles' contraction against manually applied moderate resistance. This is in addition to having normal flexibility of the lower back muscles as adequate muscle length and flexibility are important for proper joint function and movement efficiency [2]. Modified Schober test was used to assess the flexibility of the lumbar region. In this test, a mark was made at the level of the posterior iliac spine on the vertebral column i.e. approximately at the level of L5. The examiner then placed one finger 5cm below this mark and another finger at about 10cm above this mark. The participant was then instructed to touch his/her toes. If the increase in distance between both fingers on the participant's spine was more than 5cm, this indicated normal flexibility and hence the participant was included in the study. However, if the increase in the distance between both fingers was less than 5cm, then this indicated limitation in lumbar flexion [15] and the participant was excluded from the study. The exclusion criteria involved having history of previous back or abdominal surgery/injury or any previous episodes of low back pain one year prior to participating in the study [16]. Finally, the participants shouldn't have been involved in any previous strengthening or weight training programs.

B. Instrumentation

The Biodex System 3 Multijoint Testing and Rehabilitation isokinetic dynamometer (Biodex Medical System, Shirley,
NY, USA) was used for assessing the isokinteic parameters.
The system is being widely used in research, clinical testing and rehabilitation to objectively assess factors of muscle performance that would otherwise be difficult to obtain using manual testing techniques. It measures the internal torque produced by a group of muscles while the body segment is maintaining a constant angular velocity throughout a determined range of motion (ROM). In the current study, it was used for assessing the trunk flexors' and extensors' peak torques and the ratio between them. All variables were recorded in the concentric mode of muscle contraction at an angular velocity of 60º/sec throughout a 70-degree ROM. This velocity was used for evaluating the peak torque which is an indicator of the maximum muscle strength [17]-[19]. Trial-totrial and day-to-day reliability and validity torque measurement of the Biodex system 3 were all previously established [20].
C.Procedures Initially and prior to data collection, a brief orientation session about the nature of the study, its aims and the tests to be accomplished was provided to each participant. Then, informed consents were obtained from all participants. The participants were tested while sitting on the adjustable Biodex Isokinetic Dynamometer system seat. The sitting position was tested as it was reported to be the optimal resting position being more tolerated than the standing one. It allows greater ROM both in flexion and extension and hence is the preferred testing position [18], [21], [22].
To assure stability, a pelvic strap was applied and positioned as far as possible to press firmly, yet comfortably, against the superior aspect of the proximal thighs. Two curved anterior leg pads were secured to adjust the knee block position. In addition, a lumbar support pad was located against the lower lumbar spine. Hence, the pelvis was stabilized to minimize any contribution from the hip muscles [21]. Both thighs were then stabilized by two straps and the feet were held in place without being in contact with the floor. The participant sat erect with the head being stabilized neutrally against an adjustable head seat. Two anterior force application straps were aligned vertically and then connected to another horizontal strap which was aligned with the second intercostals cartilage on the anterior chest wall when measuring the flexion torque. A posterior force application padded roller bar was placed on the posterior trunk just distal to the spine of the scapula when measuring the extension torque. To prevent any jerky movement from the arms, the participant was instructed to rest his/her crossed forearms on the anterior chest wall. In addition, the participant was asked to maintain a neutral head position throughout the testing procedure to avoid any contribution from the neck muscles [22].

The tested trunk range of motion was pre-set by asking the tested participant to flex his/her trunk 50° from the vertical position. The position was confirmed with a protractor situated at the side of the testing chair. The set limit button was then pressed to lock the ROM for this direction. The participant was then asked to extend his/her trunk 20° from the vertical position and the set limit button was pressed again to lock the ROM for this direction. Thus, the isokinetic testing procedures were conducted at a ROM of 70°.

Prior to the actual isokinetic testing procedures, each participant performed one practice series of three sub-maximal trunk extension and flexion repetitions to get accommodated with the specificity of the Biodex speed of movement and trunk ROM. This was done to minimize any practice effect during the actual testing procedure.

Three practice sessions were performed. Each practice session involved performing five consecutive trunk flexionextension repetitions at the available trunk ROM (70°). The participant was instructed to push and pull as hard and as fast as possible. Verbal encouragement was given during the testing procedure to maximize the participant's voluntary effort. The mean trunk flexors' and extensors' peak torques and the mean trunk flexors/extensors ratio for the three practice sessions were recorded.

Each participant of both groups was tested for the isokinetic parameters twice with a six-week period inbetween. Participants of group I performed the beginners' core stability program during this period, while those of group II didn't.

The participants started the training with a warm-up exercise followed by three main core stability exercises; curlup, side-bridge, and bird dog. This is the most accepted program that includes components from the Saal and Saal [23] seminal dynamic lumbar stabilization efficacy study. The purpose of these fundamental core stability exercises is to gain stability, muscle balance and timing of the deep abdominal wall muscles.

The warm-up exercise involved a "Cat-Camel" motion of the spine (spine flexion-extension cycles). This exercise was done to reduce spine viscosity (internal resistance and friction) and floss the nerve roots as they exit at their respective lumbar levels. The "Cat-Camel" motion was intended as a motion exercise – not a stretch, so the emphasis was on motion rather than pushing at the end ranges of extension and flexion. Five to eight cycles were reported to be sufficient for reducing most viscous-frictional stresses [24].

After performing the warm-up exercise, each participant began to perform the beginner's core stability program. These basic exercises emphasize maintaining the lumbar spine in a neutral position which is the mid-range position between lumbar extension and flexion. All of these exercises are best done with light loads and high repetitions [25].

In the curl-up exercise, the participant's hands were placed under the lumbar spine to preserve a neutral spinal posture.

The participant was instructed not to flatten the lumbar spine.

He/she was asked to flex one knee with the other kept straight to lock the pelvis-lumbar spine and minimize the loss of the neutral lumbar posture. The curl-up exercise was performed by raising the head and upper shoulders off the floor. The motion took place in the thoracic region - not the lumbar or cervical ones. The exercise was made more challenging by raising the elbows off the floor. The participant was asked to perform abdominal bracing (activating the abdominal muscles), and then curling up against the brace. He/she was asked to hold the posture for 7-8 seconds while breathing deeply and not holding the breath. The isometric holds are recommended to be held not longer than 7-8 seconds because there is rapid loss of the available oxygen in the torso muscles contracting after these limits. Short relaxation of the muscles restores oxygen [24].

In the side-bridge exercise, the participant laid on his/her right side with the right shoulder abducted such that the upper arm was aligned vertical on the ground and the forearm rested on the floor. He/she was asked to raise the pelvis from the floor and hold it in a straight line "plank" position. The participant was asked to hold this posture on one side for 7-8 seconds. Attention was directed towards locking the pelvis to the rib cage via an abdominal brace while breathing deeply and not holding the breath [26]. Advanced variation from the side bridge exercise involved placing the upper leg-foot in front of the lower one to facilitate longitudinal rolling on the torso to challenge both the anterior and posterior portions of the abdominal wall. The participant supported himself/herself with his/her forearms rested on the floor, elbows bent 90° and toes rested on the floor. The participant maintained the spine

in a neutral position, recruited the gluteal muscles and kept the head leveled with the floor. He/she was asked to hold this posture for 7-8 seconds, breathe normally throughout the exercise while maintaining the abdominal brace. No compensatory motions such as increased lumbar lordosis or sag were permitted. The side-bridge exercise targets the lateral and abdominal muscles (quadrates lumborum, and abdominal obliques) which are important for optimal stability. The beginner's level of exercise involved bridging the torso between the elbows and knees. Once this was mastered and tolerated, the challenge was increased by bridging using the elbows and feet [24].

In the bird-dog exercise, the participant positioned himself/herself on the hands and knees and braced the abdominal wall. While maintaining a mid-range/neutral curve of the lumbar spine, the participant raised the right arm and left leg (opposite upper and lower limbs) in line with the trunk. He/she was instructed to prevent any rocking of the pelvis or spine (excessive transverse or coronal plane motion).

Again, he/she was asked to hold the posture for 7-8 seconds while breathing deeply and not holding the breath. The bird dog exercise challenges the back extensors of both the lumbar and thoracic regions. Only one half of these muscles are challenged at a time by lifting the alternate arm and leg. This reduces the spine load to about a half of that produced during traditional spine extension exercises such as roman chair extensions [24].

The beginner's core stability program used in this study was conducted thrice per week for 6 weeks. The program consisted of three phases, with each phase lasting for two consecutive weeks. The program was performed once, twice and thrice per day in the first, second and third phases respectively. The participant was asked to perform 15 repetitions for each exercise at each session [9]. The participant was instructed not to do the core stability exercises in the first hour of awakening because of the increased hydrostatic pressure in the discs during this time [27]. He/She was also instructed to maintain the bracing techniques throughout all the conducted exercises.

Bracing the spine activates all the abdominal and back muscles at once. Cues like "squeeze your tummy, back, sides and front" and "tighten a large belt or corset around your abdomen" were used to help participants to perform this technique [25].

D.Data and Statistical Analysis All statistical measures were performed through the statistical package for social sciences (SPSS) version 17 for windows. It was intended to compare between both groups "between-subject effect" for the trunk flexors/extensors peak torque ratio and the trunk flexors and extensors peak torques in each of the "pre-test" and "post-test" conditions. In addition,

it was intended to compare between the "pre-test" and "posttest" conditions "within-subject effect" for these variables in each of the tested groups. Finally, it was intended to examine the interaction effect. In this study, three dependent variables and two independent variables with two levels each were tested. The dependent variables were the trunk flexors/extensors peak torque ratio, and the trunk flexors and extensors peak torques. The independent variables were the "tested group" with its two levels (group I and group II) and the "time factor" with its two levels (pre-test and post-test conditions).

Initially and as a pre-requisite for parametric analysis, data were screened for normality assumption through using Kolmogorov-Smirnov and Shapiro-Wilks normality tests, and testing for the presence of extreme scores and significant skewness and kurtosis. In addition, data were screened for homogeneity of variance assumption. Once data were found not to violate the normality and homogeneity of variance assumptions, parametric analysis was conducted. 2x2 Mixed Design ANOVA was conducted to compare the trunk flexors/extensors peak torque ratio between group I and II in each of the “pre-test” and “post-test” conditions and to compare between the “pre-test” and “post-test” conditions for the tested peak torque ratio in each of the tested groups. Also, 2x2 Mixed Design MANOVA was conducted to compare the isokinetic trunk flexors and extensors peak torques between group I and II in each of the “pre-test” and “post-test” conditions and to compare between the “pre-test” and ‘posttest” conditions for the tested torques in each of the tested groups. As two statistical analysis tests (2X2 Mixed Design ANOVA and 2X2 Mixed Design MANOVA) were performed on the examined sample, the alpha level of significance was adjusted to 0.025 (0.05/2) for each of the two conducted statistical tests. Adjustment was performed to avoid alpha inflation and committing type I error [28], [29]. Two separate statistical tests were conducted as the first dependent variable (trunk flexors/extensors peak torque ratio) depends on the other two dependent variables (trunk flexors and extensors peak torques) in its calculation. This might violate the assumption of independence [30].

III. RESULTS

Descriptive statistics indicated that the mean±SD age, weight, and height were 20.7±2.4 years, 66.5±12.1kg and 166.7±7.8cm respectively for group I and 20.3±0.61 years, 68.57±12.2kg and 164.28 ±7.59cm respectively for group II.

As indicated by the unpaired t-tests, there were no significant differences ($p>0.05$) in the mean values of the age, weight, and height between both groups. The 2x2 Mixed design ANOVA with the subsequent multiple pairwise comparison tests revealed that there were no significant differences ($p>0.025$) between both groups for the trunk flexors/extensors peak torque ratio in the “pre-test” and “post-test” conditions. Also, there were no significant differences ($p>0.025$) between the “pre-test” and “post-test” conditions in either group I or group II. Similarly, the 2x2 Mixed design MANOVA with the subsequent multiple pairwise comparison tests revealed that there were no significant differences ($p>0.025$) between both groups for the trunk flexors and extensors peak torques in the “pre-test” condition. However, there was a significant ($p=0.01$) increase in the trunk flexors peak torque in group I compared with group II in the “post-test” condition with no significant difference ($p>0.025$) for the trunk extensors peak torque.

TABLE I

DESCRIPTIVE STATISTICS FOR THE TRUNK FLEXORS/EXTENSORS PEAK TORQUE RATIO AND FLEXORS & EXTENSORS PEAK TORQUES IN THE EXPERIMENTAL AND CONTROL GROUPS IN THE PRE-TEST AND POST-TEST CONDITIONS

Dependent variables	Tested group	Time of testing	Mean ± SD	Tested group	Time of testing	Mean ± SD
Trunk flexors/extensors peak torque ratio	Group I	Pre-test	66.18 ±11.6	Group II	Pre-test	63.12 ±13.84
		Post-test	66.88 ±12.89		Post-test	66.85 ±15.43
Trunk flexors peak torque (Nm)		Pre-test	91.71± 24.85		Pre-test	95.01 ± 16.96
		Post-test	140.34 ± 36.95		Post-test	102.91 ± 7.1
Trunk extensors peak torque (Nm)		Pre-test	141.25 ± 36.53		Pre-test	153.54 ± 44.91
		Post-test	209.76 ± 59.16		Post-test	163.96 ± 50.07

Finally, there were significant increases in the trunk flexors (p=0.000) and extensors (p=0.08) peak torques in the "post-test" compared with the "pre-test" condition in group I with no significant differences (p>0.025) in group II. It is pointed out that all the subsequent multiple pairwise comparison tests were conducted with Bonferroni adjustment of the alpha level. Table I presents the mean±SD scores of the trunk flexors/extensors peak torque ratio and trunk flexors and extensors peak torques in group I and II in the “pre-test” and “post-test” conditions.

IV. DISCUSSION

Concerning the trunk flexors/extensors peak torque ratio which is an indicator of trunk muscle balance, the statistical analysis revealed that there was no significant difference in it between group I and II in either the “pre-test” or "post-test" conditions. The homogeneity of the tested sample, indicated by the insignificant homogeneity of variance test, might be the cause of insignificance in the "pre-test" condition. Whereas, the learning effect on the testing procedures might be the cause of insignificance in the "post-test" condition.

Comparing the trunk flexors/extensors peak torque ratio between the “pre-test” and “post-test” conditions in each of the tested groups, the statistical analysis revealed that there were no significant differences in it between both conditions in either group. Our finding is opposed by the significant difference reported by [31]. They conducted a study to investigate the effect of a 6-week specific lumbar stabilization training program on muscle performance in healthy individuals. The training program involved bridging, ball bridging, unilateral bridging, and bird-dog exercises. Surface electromyographic (EMG) data of the abdominal and back muscles were obtained both before and after training. Analysis of the abdominal/back relative muscle activity ratios revealed higher ratios after training. However, it should be pointed out that they used EMG in their study and they measured separated ratios between most of the local and global muscles in the trunk; rectus abominus/erector spinae, internal oblique/iliocostalis lumborum pars thoracis, and transverses abdominis/multifidus. Using EMG enabled them to pick up any trivial activity in the muscles as it is more sensitive than other measures. The insignificant difference reported in our study might further be attributed to the fact that the studied sample involved healthy individuals. The trunk flexors/extensors peak torque ratio might have been misleading, as if both trunk flexors and extensors had approximate amount of improvement after performing the beginners' core stability program, the ratio in the "post-test" condition would remain the same as in the "pre-test" condition. With the concept of the ratio being believed to be misleading in some cases, our interest was further extended to examining the variables that are used to calculate the ratio separately (trunk flexors and extensors peak torques in the current study). Hence, this dilemma might be resolved.

The statistical analysis revealed that there were significant increases in both the trunk flexors and extensors peak torques in the "post-test" condition compared with the "pre-test" one in group I, but not in group II. These findings indicate that there was a significant effect of the beginner's core stability exercises on both trunk flexors and extensors peak torques.

Furthermore, this proves that the trunk flexors/extensors peak torque ratio was misleading, as examining each of the trunk flexors and extensors peak torques separately showed significant improvement in group I that was absent in group II.

The significant increase in the trunk flexors and extensors in the "post-test" condition compared with the "pre-test" one is supported by that reported by [32]. He described a conditioning program (for the trunk and upper limbs) that aimed to prevent injury and improve force and power generation for golf players. He declared that the performed trunk exercises (curl up, bird dog, side bridge) had the ability to adequately strengthen all trunk muscles responsible for maintaining a strong and stable spine without exceeding cautious injury thresholds for compressive and shear loading.

Through using computerized tomography (CT), [33] also approved the effect of different training schedules on the cross-sectional area of the paravertebral muscles. They found that the cross-sectional area of the paravertebral muscles increased significantly after performing either a 10-week stabilization training combined with dynamic resistance training or a 10-week stabilization training combined with dynamic-static resistance training with no systematic differences in hypertrophy between the dynamic and dynamicstatic strengthening training modes.

In the same context, the significant improvement in the trunk flexors and extensors peak torques with core stability exercises in group I is in accordance with that reported by [34]. They found that dynamic lumbar stabilization exercises performed for eight weeks significantly improved spinal mobility, trunk muscles' strength and endurance. The evaluating procedures involved assessing the fingertip-floor distance, lumbar Schober and modified lumbar Schober for spinal mobility, progressive isoinertial lifting for weight lifting capacity, and trunk muscle endurance tests.

Controversially, our finding of significant difference in the trunk flexors and extensors peak torques between the 'pretest" and "post-test" conditions in group I is opposed by the non-significance reported by [35]. They reported that there were no significant changes in the myoelectric activities of the trunk flexors and extensors between both the experimental and control groups using the Cybex strength measurements (isokinetic testing). It should be noted that they used only two types of core exercises (curl up and back extensions), and the program was performed for five weeks. But in our study, we used McGill program that consisted of four main exercises (curl up, side bridge, prone bridge and bird dog exercises), and this program was performed for six weeks.

Similar to the trunk flexors/extensors peak torque ratio, there were no significant differences in both the trunk flexors and extensors peak torques between group I and II in the "pretest" condition. Again, this may be attributed to the homogeneity of the tested sample. However, there was a significant difference in both torques between both groups in the "post-test" condition. This might be attributed to the number of exercises that addressed the abdominal muscles at the expense of the back ones. In the beginners' core stability program that was tested in the current study, the researchers used four exercises; curl-up, side-bridge, prone-bridge, and bird-dog exercises. Three of which (curl-up, side-bridge and prone-bridge exercises) were acting mainly on the abdominal muscles, while the bird-dog exercise only was acting mainly on the back muscles. This finding is supported by the findings reported by [31].

In their study, they examined the effect of a specific lumbar stabilization training program on muscle performance in healthy individuals. Analysis of the relative muscle activity levels tested by EMG showed high activity of the local (segmental-stabilizing) abdominal muscles that was not reported for the local back muscles. Minimal changes in global (torque-producing) muscle activity also occurred.

Despite that they studied the local and global muscle systems of the trunk muscles separately, they revealed that the abdominal muscles (local and global) showed higher activities than the back muscles (local and global). This difference might also be attributed to the high torque producing capabilities of the abdominals (greater lever arm and crosssection).

V. CONCLUSION

The conducted core stability exercise program was capable of improving the trunk flexors' strength much more than that of the trunk extensors without affecting trunk flexors/extensors muscle balance.

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Scientific Conferences 2013

The Contribution of Hip strategy in Dynamic Postural Control in Recurrent Ankle Sprain

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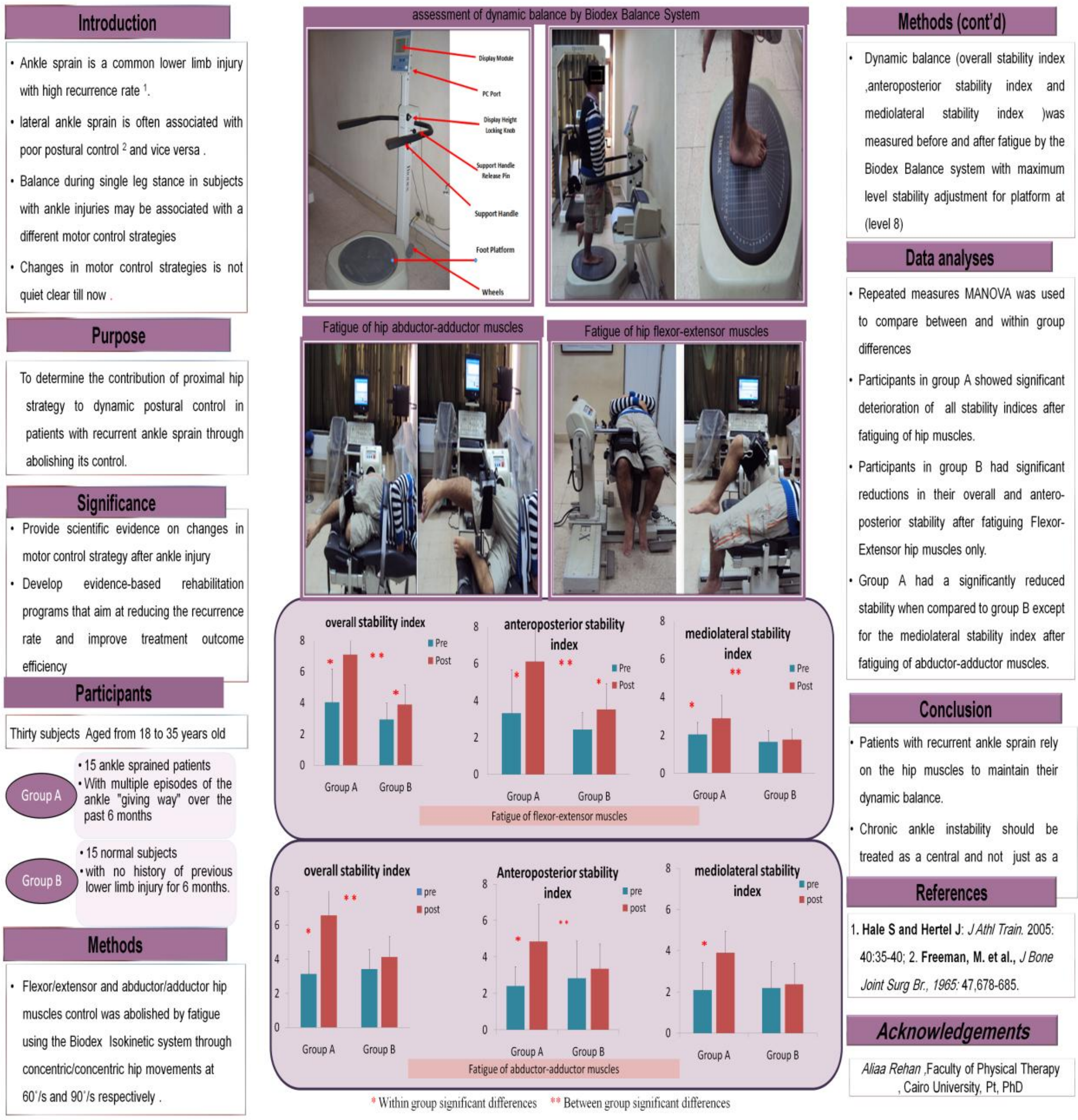

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