Post-operative Femoral Nerve Lesion: Comparison between Two Approaches of Physical Therapy

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ABSTRACT

The purpose of this study was to compare between two approaches of physiotherapy for post operative femoral nerve entrapment patients. Twenty volunteers' patients were participated in this study, diagnosed by a neurologists as femoral nerve entrapment following surgery. Their ages ranged from 31 to 66 years. Duration of illness ranged from two to four weeks after surgery. Patients were classified into two equal random groups; group (1) received electrical stimulation "ES" and quadriceps exercises, while group (2) received "ES", quadriceps exercises and pulsed ultrasound therapy. One repetition maximum (1RM) was used to measure quadriceps strength, while cadence was used to measure number of steps/minute. Both one repetition maximum and cadence were used for both groups, before and at the end of physiotherapy program. Results of this study revealed a significant improvement of both groups, regarding both quadriceps strength and cadence at the end of treatment program. However, group (2) was significantly improved; regarding both quadriceps strength and cadence; than group (1). On conclusion, the present study revealed that addition of pulsed ultrasound to quadriceps strengthening exercises and electrical stimulation has a great benefit and importance in managing patient complaining post-operative femoral nerve entrapment.

Key Words: *Femoral nerve entrapment, Pulsed ultrasound, Electrical stimulation.*

INTRODUCTION

Femoral nerve; below the inguinal ligament; gives motor fibers to quadriceps muscle and sensory branch (saphenous nerve) which innervates skin of medial thigh and the anterior & medial aspects of the leg[2]. Femoral neuropathy can occur secondary to direct trauma, compression, stretch injury or ischemia. Pathophysiologically, it is particularly compressed at the level of inguinal ligament[22]. Also, direct trauma or pressure on the nerve can occur during abdominal or pelvic surgery[24]. Appendecectomy is considered an uncommon cause. The nerve is usually is either cut or stretched. Postoperative complication such as a large blood clot (haematoma) can also injured the nerve[10]. Retractors used during pelvic operations can cause injury to the nerve due to compression[17]. Lithotomy position during delivery or urological procedures can cause compressive femoral neuropathy. Here, sharp hip flexion can compress the nerve at the inguinal ligament. Excessive abduction and external rotation cause additional stretch on the nerve[1].

Acute severe pain in the lower abdomen may occur due to retroperitoneal haematoma. Here, hip extension may cause pain.

Otherwise, the associated pain is usually mild and located near the inguinal ligament[15]. Clinically, there is pain in the inguinal region and numbness over the anterior thigh, anterior knee and antero-medial leg. Pain increased with hip extension. If compression occurs at inguinal region, there is quadriceps weakness with normal hip flexion[17]. Iliopsoas involved only if the lesion is above the inguinal ligament[10].

Quadriceps strength can be assessed through one repetition maximum (1RM), which is the maximum resistance that could be lifted throughout the full range of motion using good form one time only[21].

Prognosis depends on the cause and extent of injury[10]. Most patients with femoral neuropathy can be treated conservatively with physiotherapy[2]. Avoid excessive hip abduction during treatment. Knee bracing can be used to prevent knee buckling[24]. Quadriceps weakness may be treated with a locking knee brace[17].

Ultrasound treatment with an intensity ranged from 0.5 to two watt/cm2 may induce various biophysical effects within the tissues[3]. Ultrasound treatment might facilitate recovery from nerve compression[6]. Electrical stimulation is used to augment strength in patients with muscle weakness[7]. Faradic current is the currents that is mostly used in nerve stimulation and muscle reeducation. It is an alternating current with pulse duration of 0.02-1 ms[18].

SUBJECTS, MATERIALS AND METHODS

Subjects

Twenty volunteers patients participated in this study. All patients were diagnosed as femoral nerve entrapment following surgery. They were classified as seven following total hip replacement, five following inguinal and femoral herniorraphies, three following urosurgery, three following gynecological surgery and two following appendecectomy. Patient's age ranged from 31 to 66 years. Thirty patients were males while seven were females. Duration of illness ranged from two to four weeks after surgery. Patients were classified into two equal random groups (regardless surgery) matched in age. Group (1) received electrical stimulation and quadriceps exercises only, while group (2) received electrical stimulation, quadriceps exercises in addition to pulsed ultrasound.

Inclusion criteria:

All patients complained (after surgery) inability to lock the knee in extension and occasional giving way during walking. They also complained difficulty in stair climbing, especially downstairs. They were diagnosed as femoral nerve entrapment by a neurologist.

Exclusion criteria:

There were no lumbosacral plexus lesion (normal MRI lumbosacral spine at L2,3,4 levels). None of patients was diabetic.

Procedures

All patients were submitted to:

A- Clinical neurological assessment: Using a thorough design of history taking and clinical neurological examinations.

B- Investigations:

All patients were submitted to:

1. MRI lumbosacral region.
2. Blood sugar level.

Methods

Evaluation procedures:

One repetition maximum (1RM):

Quadriceps strength was measured by (1RM), which is the maximum weight that the muscle could move just one time[21]. The subject sit with his back straight and thighs well supported by the seat. In this position,

affected knee was tested from 90 degrees flexion to maximum allowable extension then return to the starting position[9].

Cadence:

Cadence was used to measure number of steps per minute. A quantitative method of gait analysis was used. The procedure requires only a stopwatch; two felt tip marking pens with washable ink and six meters walkway[5].

Treatment procedures:

1. Ultrasound: Pulsed ultrasound was applied (for group 2 only) with an intensity of 1.5 watt/cm2 on the inguinal ligament of the affected leg; for five minutes; while the patient lied supine[3].
2. Electrical stimulation: Faradic stimulation was applied for both groups of patients on vastus medialis muscle for 20 minutes. The electrodes were applied as the proximal electrode applied on the inguinal canal, just distal and medial to inguinal ligament, while the distal electrode applied on the distal margin of vastus medialis; 5-7 cm superior and medial to the superior pole of patella. Stimulus duration was 1ms[12].
3. Quadriceps exercises: They applied for both groups in a form of isometric exercises, eccentric exercises for vastus medialis and isokinetic exercises for the quadriceps from 90° knee flexion. Each exercises was performed 30 repetition, with a rest period for one minute every five repetitions. Each patient (from each group) performed three sessions per week, for two weeks.

RESULTS

I. Quadriceps strength

(1): group (1):

There was a statistically significant increase in the mean strength of quadriceps at the end of treatment program ($p < 0.05$) (Table 1, Fig. 1).

Table (1): Mean difference in quadriceps strength of group (1); between before and after treatment.

Item	Quadriceps strength (pre)	Quadriceps strength (post)
Mean	1.6	2.6
Mean Difference	1	
S.D ±	0.94	
t	3.02*	

*Significant ($p<0.05$).

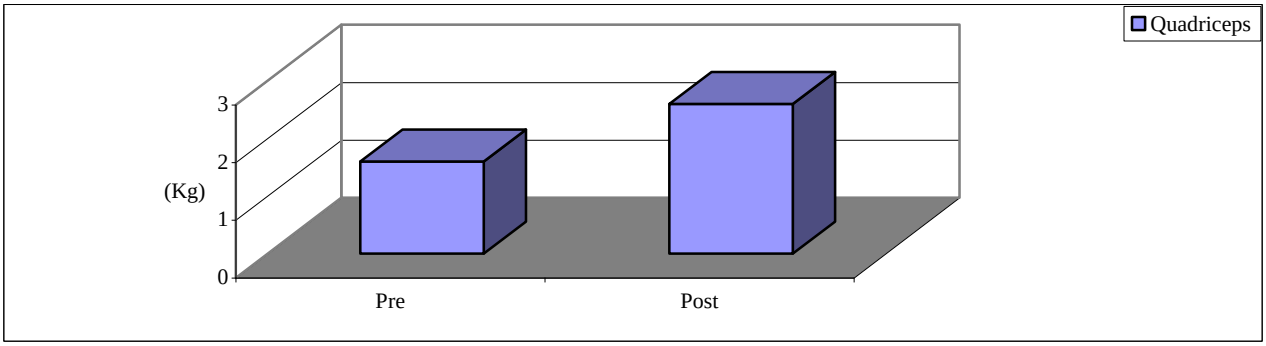

Fig. (1): Mean difference in quadriceps strength of group (1); between before and after treatment.

(2): Group (2):

There was a highly statistically significant increase in the mean strength of quadriceps at the end of treatment program ($p<0.01$) (Table 2, Fig. 2).

Table (2): Mean difference in quadriceps strength of group (2); between before and after treatment.

Item	Quadriceps strength (pre)	Quadriceps strength (post)
Mean	1.5	10.4
Mean Difference	8.9	
S.D ±	4.14	
t	6.88**	

**Highly significant ($p<0.01$).

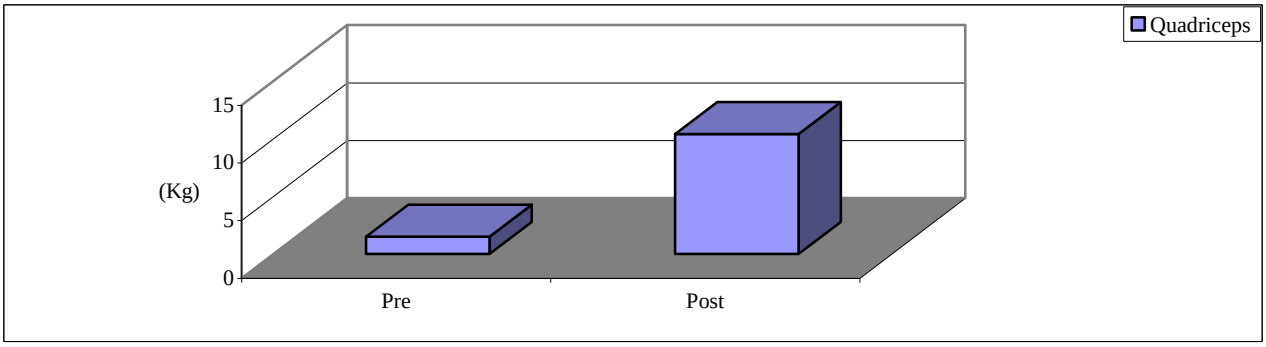

Fig. (2): Mean difference in quadriceps strength of group (2); between before and after treatment.

(3): Comparison between group (1) and group (2):

By comparing the degree of improvement in quadriceps strength in both group (1) and (2), there was a highly statistically significant improvement in the quadriceps strength of group (2) compared to group (1) ($p<0.01$) (Table 3, Fig. 3).

Table (3): Comparison between the degree of improvement of quadriceps strength of group (1) and group (2).

Item	Quadriceps strength	
	G1 (Post-Pre)	G2 (Post-Pre)
Mean	1	8.9
S.D ±	2.92	
T	6.08**	

**Highly significant ($p<0.01$).

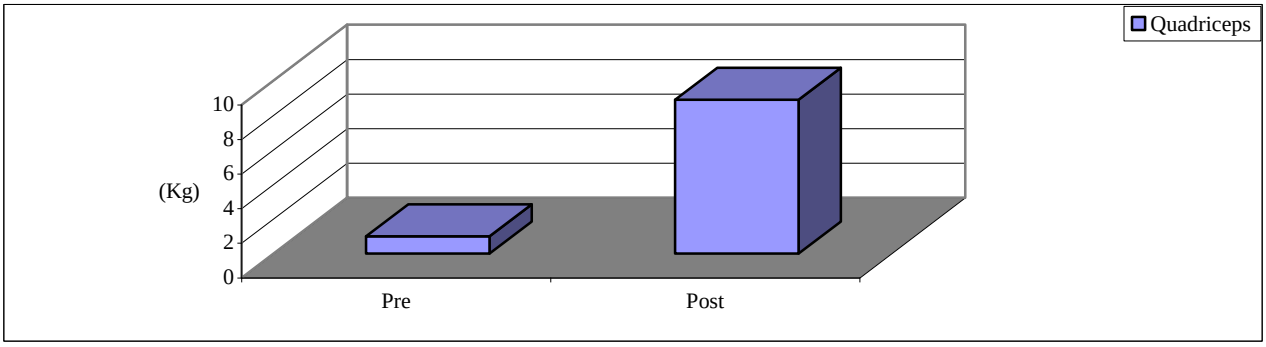

Fig. (3): Comparison between the degree of improvement of quadriceps strength of group (1) and group (2).

II. Cadence:

(1): Group (1):

There was a highly statistically significant increase in the mean cadence at the end of treatment program ($p<0.01$) (Table 4, Fig. 4).

Table (4): Mean difference in cadence of group (1); between before and after treatment.

Item	Cadence (Pre)	Cadence (Post)
Mean	32.9	34.9
Mean Difference	2	
S.D ±	1.41	
t	4.48**	

**Highly significant ($p<0.01$)

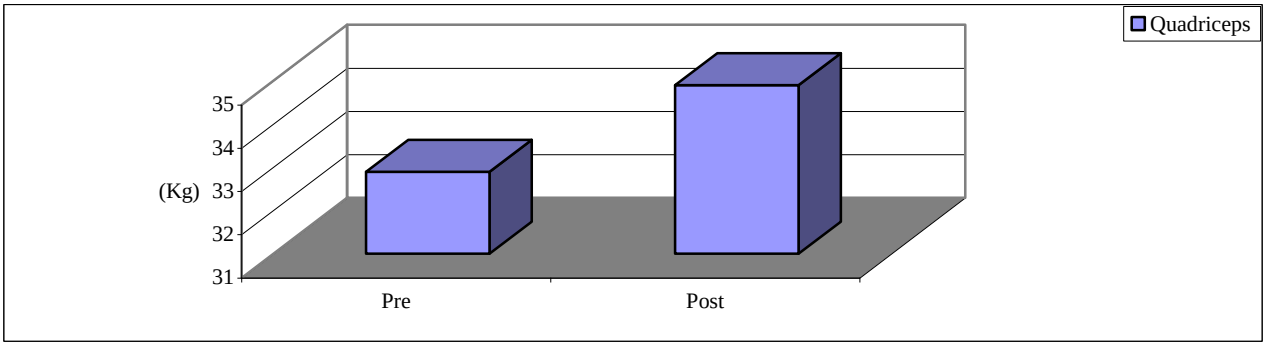

Fig. (4): Mean difference in cadence of group (1); between before and after treatment.

(2): Group (2):

There was also a highly statistically significant in the mean cadence at the end of treatment program ($p<0.01$) (Table 5, Fig. 5).

Table (5): Mean difference in cadence of group (2); between before and after treatment.

Item	Cadence (Pre)	Cadence (Post)
Mean	27.5	89.8
Mean Difference	62.3	
S.D ±	3.62	
t	54.38**	

**Highly significant (p<0.01)

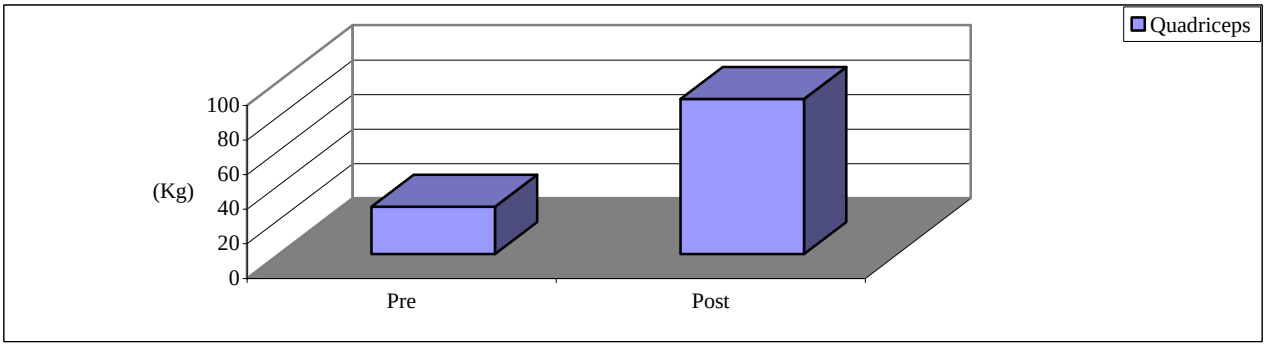

Fig. (5): Mean difference in cadence of group (2); between before and after treatment.

(3): Comparison between group (1) and group (2):

By comparing the degree of improvement in cadence in both group (1) and (2), there was a highly statistically significant improvement in cadence of group (2) compared to group (1) (P<0.01), (Table 6, Fig. 6).

Table (6): Comparison between the degree of improvement in cadence of group (1) and group (2).

Item	Cadence	
	G1(Post-Pre)	G2(Post-Pre)
Mean	2	62.3
S.D ±	2.75	
t	49.02**	

**Highly significant (p<0.01)

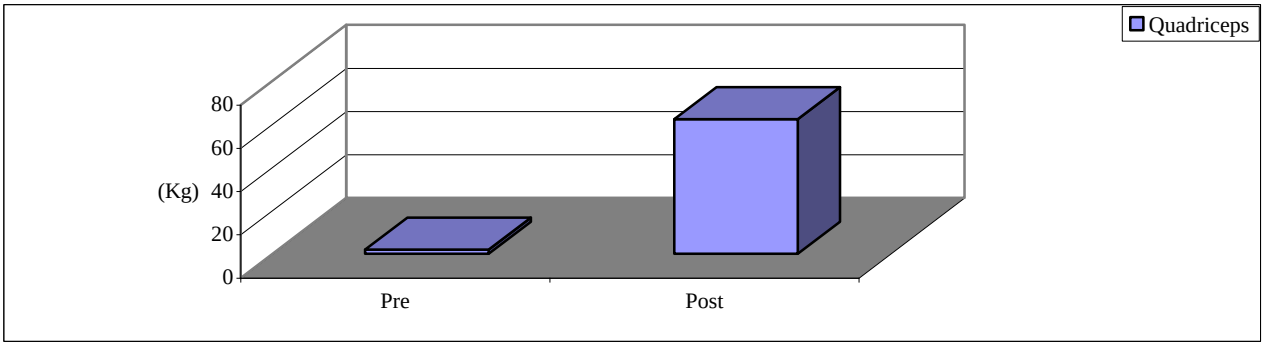

Fig. (6): Comparison between the degree of improvement in cadence of group (1) and group (2).

DISCUSSION

This study was applied to compare between two approaches of physical therapy in management of post – operative femoral nerve entrapment. Patients were divided into two equal groups, group (1) received ES and quadriceps strengthening exercises, while group (2) received the same program of group A; in addition to pulsed ultrasound.

Quadriceps strength and cadence were measured before and at the end of treatment program.

Results revealed that there was a significant improvement regarding quadriceps strength in both groups at the end of treatment program. This occurred as the mechanisms for improvements in muscle strength observed after any form of training can be peripheral or central in nature. In addition ES acts by the direct stimulation of muscle fibers, as reflected by changes in size and/or biological profile after stimulation[4].

This was in agreement, as ES lead to greater improvement in quadriceps strength in severely disabled patients[12]. After quadriceps strengthening exercises, there was an increase in isokinetic measurement of quadriceps extension, compared to that of untrained control group[19].

Results also revealed that there was a highly significant improvement regarding cadence in both groups at the end of treatment program. This may be due to increase in muscle strength of the lower limb muscle groups; which are primarily responsible for the work of walking; termed generators[20]. This was in agreement, as resisted quadriceps exercises improve gait performance, explained by increasing number of steps per minute[16,23].

Results revealed that both quadriceps strength and cadence were highly significantly increased in group (2) than (1). This could be attributed to the effect of pulsed ultrasound, as it was expected that ultrasound broke post-operative adhesions that may compress the femoral nerve and causing its entrapment. This was in agreement with experiments acting upon stimulation of nerve regeneration and on nerve conduction by ultrasound treatment and with findings of an anti-inflammatory effect of such treatment, which supported the concept that ultrasound treatment might facilitate recovery from nerve compression[11,14]. On agreement to that concept, there was a significant positive effect of ultrasound treatment in patients with entrapment of median nerve at carpal tunnel[8]. Femoral nerve lesion can be managed conservatively depending on the underlying cause[13]. ES and quadriceps strengthening exercises only can manage quadriceps weakness without causal management, and addition of pulsed ultrasound is essential.

On conclusion, addition of pulsed ultrasound to quadriceps strengthening exercises and electrical stimulation has a great benefit and importance in managing patient complaining post-operative femoral nerve entrapment.

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الملخص العربي

إصابة العصب الفخذي الأمامي بعد الجراحة : مقارنة بين أسلوبين للعلاج الطبيعي

أجريت هذه الدراسة لمقارنة أسلوبين في العلاج الطبيعي لعلاج إصابة العصب الفخذي الأمامي بعد الجراحة . شارك في هذه الدراسة عشرون مريضا متطوعا تم تشخيصهم - بواسطة أخصائيي أمراض عصبية- كإصابة للعصب الفخذي الأمامي بعد الجراحة –وقد تراوحت أعمار المرضى مابين 31 و 66 عام بينما تم بدء البرنامج العلاجي للمرضى مابين أسبوعين إلى أربعة أسابيع بعد الجراحة . تم تقسيم المرضى عشوائيا إلى مجموعتين متساويتين : مجموعة (1) وقد عولجت باستخدام التنبيه الكهربائي مع تمرينات تقوية للعضلة الرباعية الأمامية للفخذ- ومجموعة (2) وقد عولجت باستخدام التنبيه الكهربائي مع تمرينات تقوية للعضلة الرباعية الأمامية للفخذ بالإضافة إلى الموجات فوق الصوتية المتقطعة . تم استخدام الحد الأقصى لتكرار واحد لقياس قوة العضلة الرباعية الأمامية للفخذ كما تم استخدام معدل إيقاع الخطوة (عدد الخطوات في الدقيقة الواحدة) لكل من المجموعتين - وذلك قبل وبعد الانتهاء من برنامج العلاج الطبيعي . أظهرت النتائج تحسنا ذو دلالة إحصائية عند انتهاء البرنامج العلاجي في كل من قوة العضلة الرباعية الأمامية للفخذ ومعدل إيقاع الخطوة وذلك لكلا المجموعتين ولكن بنسبة تحسن أفضل (داله إحصائيا) للمجموعة (2) مقارنة بالمجموعة (1) . ونستخلص من هذه النتائج أن إضافة الموجات فوق الصوتية المتقطعة إلى تمرينات التقوية والتنبيه الكهربائي للعضلة الرباعية الأمامية للفخذ ذو فائدة علاجية وأهمية كبيرة للاستشفاء وخاصة في حالات لمرضى الذين يعانون من إصابة العصب الفخذي الأمامي بعد الجراحة .

الكلمات الدالة : إصابة العصب الفخذي الأمامي - الموجات فوق الصوتية المتقطعة - التنبية الكهربائي .