Efficacy of Muscle Energy Technique versus Static Stretching Technique in Increasing Hamstring Flexibility Post Burn Contracture

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Background: Post burn contracture represent a major dilemma facing burn management team especially physical therapist. Several treatment modalities such as stretching, muscle energy technique, and thermotherapy have been utilized to increase the flexibility and regain lost range of motion and function. There is lack of evidence to allow conclusions to be drawn about either muscle energy technique or static stretching technique in increasing the flexibility of hamstring muscle post-burn contracture.

Objective: The purpose of this study was to determine the best stretching exercises to increase flexibility in post burn contracture of the hamstring muscle, as measured by knee extension range of motion.

Materials and Methods: Thirty male patients ranging in age from 18 to 32 years and who had decreased hamstring muscle flexibility as a result of partial thickness burn were classified into 3 equal groups 10 of each, Group (1): received Muscle Energy Technique(MET) , Group (2): received 1 minutes of static stretching exercise. And Group (3): received nothing. Measurements of knee extension range of motion were conducted before treatment, post 5 days of treatment, and after 8 days of treatment.

Statistical analysis: One way Analysis of variance (ANOVA) was used. The level of significant was set at 0.05 for all statistical tests.

Results: Both treatment groups (MET and static stretching) had highly significant ($P< 0.001$) gains in knee extension ROM after 5 and 8 days post stretching exercises. But MET had highly significant ($P< 0.001$) gains in knee extension ROM than static stretching after 8 days of treatments.

Conclusion: The results of this study suggest that MET is more effective than static stretching alone to improve a hamstring muscle flexibility post burn contracture.

Keywords: Burn, Contracture, Range of motion, MET, Static stretching, Flexibility.

INTRODUCTION

As a result of increase in the burn survival rates in the past few decades[1], more attention is given to issues of morbidity and function. Investigators give more significant time and energy in preventing and treating contractures. Clinicians have examined the prevention of contracture [2–5] and treatment options, such as splinting,4,[6,7] serial casting[8], ultrasound[9], silicone gel[10], exercise[11], and surgical correction[12].

The presence of contractures place many patients at risk for additional medical problems and functional deficits, these contractures interfere with skin and graft healing. Functionally, the presence of contractures in the lower extremities interferes with transfers, seating, and ambulation. On the other hand, activities of daily living, which include, grooming, dressing, eating, and bathing, as well as fine motor tasks may be affected by the presence of contractures in the upper extremities[13].

Muscle energy technique (MET) is a manual technique which targets the soft tissues primarily (although it makes a major contribution towards joint mobilization) has developed by osteopaths and is now used in many different manual therapy professions. This approach has been termed as muscle energy technique or active muscular relaxation technique. It is thought to be beneficial for a variety of purposes such as lengthening a shortened muscles, as a lymphatic or venous pump to aid the drainage of fluid or blood and increasing the range of motion [14].

The effect of muscle energy technique (MET) on post burn hamstring extensibility has not specifically been examined , although several studies have investigated various muscle flexibility treatments on joint range of motion (ROM)[14–16] . These studies have established that static stretching and MET are both effective in improving joint flexibility in comparison to control groups. However , there is still some conjecture about which is the most effective method to be used by practitioners[17].

Some researchers have found no difference between the effectiveness of isometric stretching techniques and passive stretching on hamstring muscle extensibility. Gribble et al[15] compared the effects of static stretching with hold relax stretching on the hamstring muscle flexibility measured using Straight Leg Raise (SLR), and active knee extension (AKE), he concluded that both of these techniques improved flexibility, however no significant differences between the effectiveness of these techniques were found.

On the other hand, several studies, MET and Proprioceptive neuromuscular facilitation (PNF) have shown to produce greater joint ROM and hamstring extensibility in comparison with passive and static stretching[16,18,19].

The purpose of the current study is to compare the effectiveness of muscle energy technique and static stretching technique on the flexibility of hamstring post burn contracture.

MATERIALS AND METHODS

This is an Experimental study of pretest-posttest design. The study protocol was approved by the research committee of Faculty of Physical Therapy, Cairo University. Patients treated from burn injuries at El-Hussein teaching hospital were randomly selected for participation in this study. This study eligibility required that patients be more than 18 years of age; 3 to 8 months after the occurrence of the burn injury; had unilateral scars across popliteal fossa of the knee and the percentage of burn did not exceed 20%, and had no history of other lower extremity pathology.

Inclusion assessment to participate in the study, subjects must have exhibited unilateral tight hamstring muscles. Operationally defined as having greater than 30 degrees loss of knee extension[20] . In addition, subjects who were not involved in any exercise activity at the start of the study had to agree to avoid lower extremity exercises and activities other than those prescribed by the research protocol. During the 8 days of training 20 male subjects, with age range from 18 to 32 years, met the established criteria and completed the study. All subjects received demonstration about the objective and procedure of the study and they were allowed to withdraw from the study at any time upon their request. All subjects read and signed an informed consent form before participating in the study. Ethical approval was obtained from Institutional Ethics committee.

Table 1 Baseline Data

Characteristics	Groups G 1 Mean ± SD	G 2 Mean ± SD	G3 Mean ± SD	P value [Y]
Age (years)	25.43 ± 1.52	24.95± 1.38	25.48 ± 1.06	>0.05#
Depth of burn (millimeters)	2.31± 0.22	2.25 ± 0.35	2.35 ± 0.38	>0.05#
Duration post burn (months)	6.30 ± 0.82	5.90 ± 0.87	5.70 ± 0.94	>0.05#
% of burn	17.30 ± 1.49	16.70 ± 1.63	16.70 ± 2.35	>0.05#

[Y]- Student t test, #- Not Significant (p >0.05)

Group assignment

To ensure equal distribution of hamstring muscle contracture, the patients were stratified into three groups based on their degree of hamstring muscle contracture. Patients assigned to group 1 (n=10 patients, age= 25.43 years) served as treatment group 1 and received static stretch for 1 minute. Patients assigned to group 2 (n=10 patients, age= 24.95 years) served as treatment group 2 and received muscle energy technique. Patients assigned to group 3 (n=10 patients, age= 25.48 years) served as control group 3.

Procedure

Measurement procedure:

Popliteal Angle/ Active Knee Extension Test:

Pre-post and follow up measurement data on Popliteal angle were collected from both treatment groups and control group. Patients were assessed for hamstring tightness using the Active Knee Extension test (Popliteal angle). The patient was in supine position with hips and knee flexed to 90°. To maintain the proper position of hip and thigh a cross bar was used at the level of knee. Testing procedure was done on the right then the left lower extremity alternatively. Either left or right lower extremity or the pelvis was strapped to the table for stabilization and control of any substitutions movements. Greater trochanter, lateral condyle of femur and the lateral malleolus were the landmarks which have been used to measure hip and knee range of motion and were marked by a skin permanent marker. The goniometer fulcrum was centered over the lateral condyle of the femur with the proximal arm straped along the femur using greater trochanter as a reference. The distal arm was directed with the lower leg using the lateral malleolus as a reference. The hip and knee of the tested lower extremity were placed into 90° flexion with the anterior aspect of thigh in contact with the horizontal cross bar frame at all times to keep hip in 90° flexion. The patient was then instructed to extend the tested lower extremity as can until a mild stretch sensation was felt .A standard goniometer was then used to measure the angle of knee flexion. An average of the three repetitions was taken as the final reading for Popliteal Angle [21].

Treatment procedure:

The treatment was given for 5 consecutive days and a follow-up measurement on 8th day was done. The subjects were tested approximately at the same time of each day.

Group-(1) (Muscle Energy Technique): The muscle energy technique was applied to the experimental group (1). The patients were instructed to extend the knee until the patient reported any hamstring discomfort then a moderate isometric contraction (approx 75% of maximal) of the hamstring muscle was then elicited for a period of five second. The technique was repeated three times After a period of three seconds of relaxation, (for a total of four contractions)[14].

Group-(2) (Static stretching technique): All patients in this group performed the static stretch to the hamstrings by the following method. In a long sitting position, each subject rested the heel of the untreated lower extremity along the medial surface of the treated thigh. The subject then reached forward to grasp the ankle of the treated lower extremity. Each subject then performed one continuous stretch to pain tolerance, without bouncing, for 1 minute.

Table 2 Comparison of Popliteal angle between the groups at Baseline

Popliteal angle (Degrees)	Groups					
	G1	G2	G1	G3	G2	G3
Mean	93.000	93.890	93.000	92.860	93.890	92.860
SD	0.9534	0.9433	0.9534	1.078	0.9433	1.078
p value [Y]	>0.05#		>0.05#		>0.05#	

[Y]- 1 Way ANOVA, #- Not Significant (p >0.05)

Table 3 Comparison of Popliteal angle between the groups after 2 weeks

Popliteal angle (Degrees)	Groups					
	G1	G2	G1	G3	G2	G3
Mean	106.10	102.30	106.10	99.250	102.30	99.250
SD	1.912	1.494	1.912	0.7792	1.494	0.7792
p value [Y]	<0.001*		<0.001*		<0.001*	

[Y]- 2 x 3 Way ANOVA, *- Highly Significant p< 0.001

Group-(3) (Control – No intervention): The control group subjects performed no stretching or any strengthening exercise for 8 days.

Statistical analysis

The equivalence of treatment groups regarding the amount of knee flexion contractures prior to the study was checked by conducting one way analysis of variance on knee range of motion. Inferential analysis of the data obtained in this study was done via 2 X 3 analysis of variance experimental design for treatments-by-treatments by subjects. For all statistical tests and all follow-up tests, the 0.05 level of probability was used.

RESULTS

The descriptive characteristics of the patients in both treatment groups and control group are shown in **Table 1.** There was no statistical difference between the two treatment groups and control group regarding the age, depth of burn, percentage of burn and the duration post burn.

In the first treatment group (MET), the mean values for knee extension were 93.0 degrees (SD = ± 0.9534), for the pre-test measurement, 93.890 degrees (SD = ± 0.9534), for the second treatment group i.e: static stretching, and 92.860 degrees (SD = ± 1.078) for control group i.e: no intervention. One way analysis of variance demonstrated no statistically significant difference between the two treatment groups and control group in knee extension range of motion (popliteal angle) (P>0.05) as shown in **Table 2.**

In the first treatment group (MET), the mean values for knee extension were 106.10 degrees (SD = ± 1.912), for the post(2) treatment measurement, 102.3 degrees (SD = ± 1.494), for the second treatment group i.e: static stretching, and 99.250 degrees (SD = ± 0.779) for control group i.e: no intervention . One way analysis of variance demonstrated a statistically highly significant difference between the two treatment groups and control group regarding knee extension range of motion (P<0.001) as shown in **Table 3**.

DISCUSSION

The review of existing literature regarding the role of different techniques in improving flexibility reveals a confusing picture. Therefore our study was designed to obtain a more thorough understanding of which is more effective MET or static stretching technique in increasing the flexibility of hamstring muscle post burn contracture in the clinical setting. According to the data, in a treatment lasting 14 days, MET technique or static stretching achieved a highly significant increase in knee extension ROM in comparison to control group which received no intervention.

The results of the current study support the findings of other studies [17,22,23] that either static stretching or MET technique is effective in increasing hamstring muscle length post burn contracture. On the other hand, the MET technique was highly significant in increasing the flexibility of hamstring muscles post burn contracture than static stretching alone , this finding was supported by the findings of Bandy et al [20] who identified that 30 seconds was the optimal duration for an effective stretch and MET, which can maintain muscle elongation for the same duration, may also generate a similar increase in muscle length by a combination of creep and plastic change in the connective tissue[24], an increase in flexibility after muscle energy technique (MET) happened due to either biomechanical or neuro-physiological changes or may be due to an increase in tolerance to stretching[20,25].

The above findings may be attributed to the fact that MET differs from static stretching as it involves an active isometric contraction of the muscle under stretch from the patient against the resistance of the therapist in addition to passive static stretching. Chaitow (1996)[26] recommended passive stretching of the hamstring to a sense of tension , followed by an active , moderate force isometric contraction of hamstrings against therapist resistance, and then an active contraction of the quadriceps muscles by the patients to reach increased range of motion[27]. i.e. that range which have been gained by static stretching was kept by both isometric contraction of the same muscle to be stretched and active contraction of the antagonist muscle.

CONCLUSION

On the basis of present study, it can be concluded that either MET or static stretch technique were able to increase the popliteal angle i.e. improvement in the hamstring flexibility in post burn contracture. However we can clearly state that MET is more efficient in improving muscle flexibility in post burn contracture than static stretching technique.

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CONFLICTS OF INTEREST

None declared

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