The Effect of Ultrasonic Versus Myofascial Release on Range of Motion of Ankle Dorsiflexion in Chronic Burned Tendoachilles

*** Wafaa H. Borhan PT.D; * Maher A. El Keblawy PT.D;**
*** Adel A. Nusser Ph.D and ** Salah Abdel Gany Ph.D**
* Faculty of Physical Therapy Cairo University.
** Faculty of Medicine, Department of Surgery, Cairo University.

ABSTRACT

The aim of the present study was to investigate the effect of ultrasonic and myofascial release on range of motion of ankle dorsiflexion in chronic burned tendoachilles. Fourty five patients with chronic burned tendoachilles (second degree-superficial type) participated for the present study. Their age were ranging from 25 to 45 years. They were classified randomaly and equally into three groups. Each group received twelve sessions at a rate of three times per week. The first (control) group received only autopassive exercises for the tendoachilles. The second group received ultrasonic and autopassive exercises. Assessment of range of motion and gait were done before treatment (pre-test) and after twelve sessions (post-test). The third group received myofascial release and autopassive exercises. The results of the present study showed significant improvement in range of dorsi flexion of the ankle in group III followed by group II. The mean value of ROM before treatment in GIII = 36, 53° and in GII-39.87°. It increased after treatment to reach 46.53° in GIII and 45.47° in GII. Th percentage of improvement were 5.66%, 15.6% and 29.6% in GI, GII, GIII respectively. Gait as a functional activity was normalized with a percentage of 26.67% in the third group and also highly significant improvement was observed in this group (60.00%) followed by the second group (13.33%). On the other hand insignificant improvement was observed the first group. It was concluded that myofascial release is more effective than ultrasonic in increasing ankle range of motion in chronic burned tendoachilles.

INTRODUCTION

It is well known that, following burn, the connective tissue elements of fascia, skin, muscle and tendon are predisposes to adhesions[9,14]. Connective tissue is loose, dense, or organised. It contains reticulin, collagen, and variable elastin fibres in a ground substance. The collagen fibril is an aggregation of tropocollagen rods in staggered array. Chemical bonding between the tropocollagen molecules leads to increased insolubility and tensile strength. However, the process is reversible[15,16].

Regardless of the surface area involved in a foot and ankle burn, plantar flexion contractures are the most common. Plantar flexion puts the gastrocnemus and soleus muscle complex on slack, encouraging heel cord tightness[8,11,15,24].

is important to explain, however, the benefit of going through the pain to get an effective result[6,10].

The aim of the present study was to investigate the effect of ultrasonic and myofascial release on range of motion of ankle dorsiflexion in chronic burned tendoachilles.

MATERIAL AND METHODS

Subjects

Fourty five participants were included in the current study (30 males & 15 femals). They had second degree (supeficial type) of burned tendoachilles with duration ranging from four to six months.

Their ages were ranging from 25 to 45 years. The size of burned tendoachilles were ranged from 40 to 50cm^2. Participants had no previous disorders which might interfere with the study (trauma, prepheral vascular diseases etc). They were recruited from Om-Elmasrin Hospital & Cairo Metropolitan areas. They were classified randomly and equally into three groups as follows:

G1: (control) received twelve sessions of ten minutes autopassive exercises for ankle dorsiflexors.

G2: Received twelve session of ultrasonic for the tendoachilles followed by autopassive exercises for ankle dorsi flexors.

G3: Received twelve sessions of myofascial release for the tendoachilles followed by autopassive exercises for ankle dorsiflexors.

Material

* Plurimeter V-inclinometer
* Ultrasonic machine, sonopuls 434-universal ultrasound therapy unit L MHz with intensity 1-2 w cm^2, and continuous mode.

Evaluative Procedure

Active range of motion of ankle excursion, (from complete planter flexion to complete dorsiflexion) was measured for each participant using plurimeter-V-inclinometer Patients were postioned in long sitting, the pluerimeter V-inclinomer was postioned on the lateral aspect of foot, in which its center was fixed on the meeting junction of lateral aspect of foot & line between lateral maleolus and head of fibula. The patient was instructed to perform dorsiflexion from complete planter flexion. The test was done before treatment and after 12 sessions of treatment.

Functional assessment of gait was done for each patient before treatment and after 12 sessions, in which the following grades was indicated[14]:

0 = Patient s affected foot in planter flexion at all phases of gait.

1 = Patient can not move the affected foot from complete planter flexion more than mid position between dorsi and planter flexion during gait.

2 = Patient can move the affected foot from planter flexion to partial dorsiflexion during gait.

3 = Patient can move the affected foot from planter flexion to complete dorsiflexion during gait.

Treatment Procedure

Ankle dorsiflexion autopassive exercises

Patients were instructed to put the affected leg in the front, while they were in walk standing position. The patients were

performed flexion knee of the front leg, with maintaining the planter surface of feet on the floor, and pushing their body weight forward to the limit of pain in tendoachilles and return to starting position. The procedure was repeated for ten minutes.

Ultrasonic

Patients were postioned in prone lying, Thixotropic agents (aquasonic gel) was applied, over the affected area, application of ultrasonic, on the tendoachilles with intensity ranging from 1, 5 to 2W/cm^2 of continuous mode. The frequency of the unit was adjusted at 1 MHz. The duration of treatment was 8-10 minutes (1 minute/5 cm^2)[22].

Myofascial release

Patients were positioned in prone lying. Application of vertical technique and cross hand technique over the tendoachilles were used. Each technique was applied three to five minutes. The patients were instructed to be relaxed during application of pressure over the tender points. The session time was ten minutes.

RESULTS

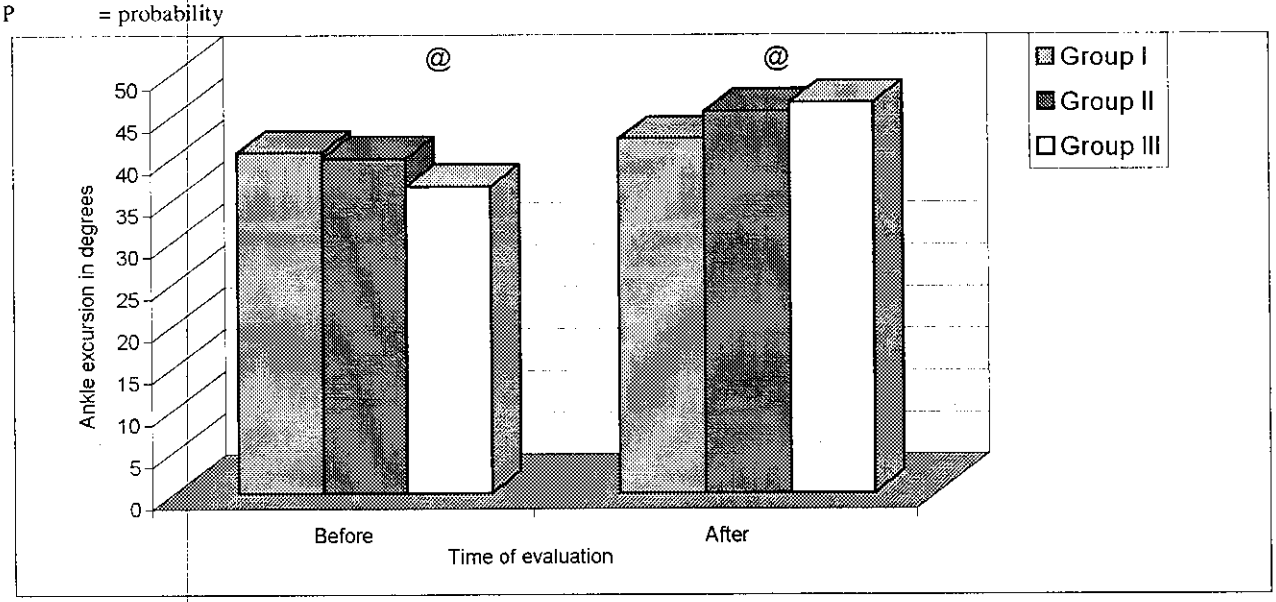
Table (1) and figures (1 and 2) show the mean values and SD for the ankle excursion of the three investigated groups before & after treatment. Thus in group I the mean before treatment was 40, 60°±10.18 it increased to 42-20°±8.91 after treatment & the t-test was 2.57. This change was clinically insignificant. In GII the mean of dorsiflexion was 39.87°±8.13 before treatment & increased after treatment to 45-47°±7.69. The t-test was 5.74. The increase of range of motion is highly significant in this group, but it was more in the third group in which the mean value of range motion before treatment was 36.53°±9.19. It increased to 46.53°±46.53 after treatment and t-test was 16.85. The percentage changes were 5.66% (GI), 15.6% (GII), 29.6% (GIII). The highest increase of range of motion was observed more in GIII followed by group II.

Table (2) and figure (3) show the improvement of gait as a functional activity of the three investigated groups. Gait as a functional activity was normalized with a percentage of 26.67% in the third group and also highly significant improvement was observed in this group (60.00%) followed by the second group (13.33%). On the other hand Insignificant improvement was observed the first group.

Table (1): Range of motion of Ankle excursion before and after treatment in the three investigated groups

No.	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
	Group I		Group II		Group III	
1	30	32	40	45	42	50
2	45	45	50	55	45	55
3	48	48	30	36	30	42
4	50	50	42	46	35	46
5	20	25	48	55	20	32
6	30	30	32	38	40	52
7	50	52	40	47	33	38
8	48	50	50	58	40	53
9	50	50	25	40	50	58
10	38	38	32	40	48	54
11	40	45	36	40	26	34
12	43	44	48	56	30	43
13	46	44	50	50	50	60
14	48	50	35	36	40	48
15	28	30	40	40	24	33
Mean	40.60	42.20	39.87	45.47	36.53	46.53
S.D.	10.18	8.91	8.13	7.69	9.19	9.19
T.Test	2.57		5.74		16.85	
P.value	<0.05*		<0.01**		<0.01**	
% change	5.66		15.6		29.6	

SD = Standard duration.
P = probability



@ = Not Statistically Significant

Fig. 1: Ankle excursion of the three groups before and after treatment

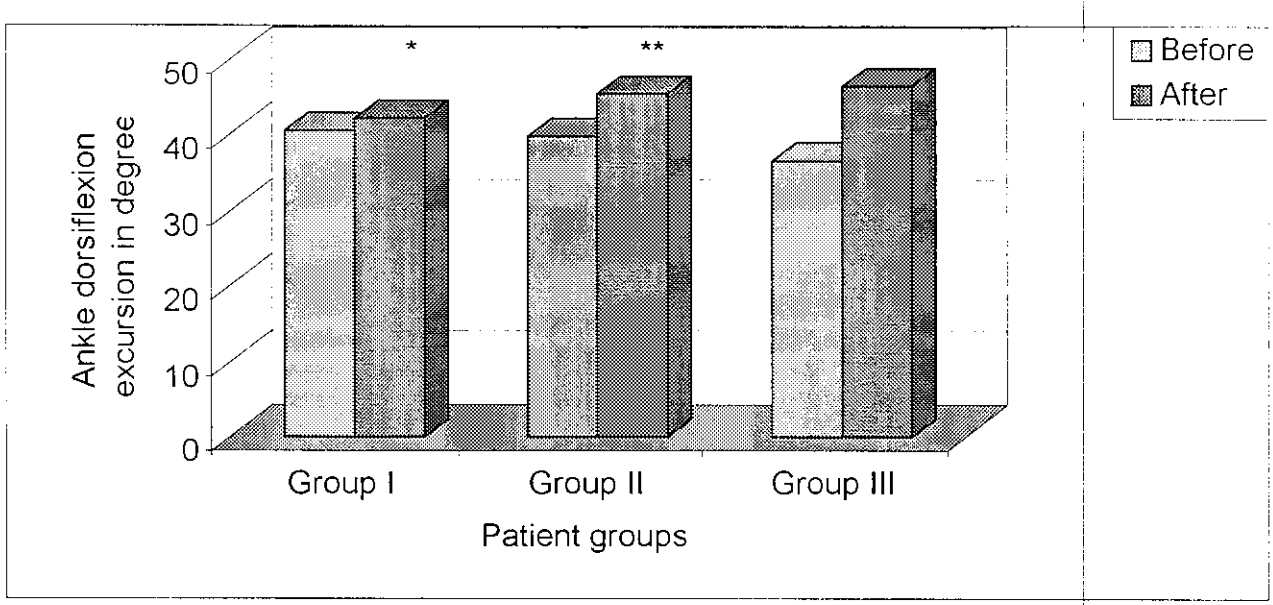


Fig. 2: Comparison between groups before and after treatment.

Table (2): Improvement of gait (functional activity) of the three investigated groups in post-test

	No Improvement		Improvement +		++		+++		Total
	No	%	No	%	No	%	No	%	
Group 1	13	86.67	2	13.33	0	0.00	0	0.00	15
Group 2	3	20.00	10	66.67	2	13.33	0	0.00	15
Group 3	0	0.00	2	13.33	9	60.00	4	26.67	15
Total	16		14		11		4		45

Chi-Square 46.699 P 0.001

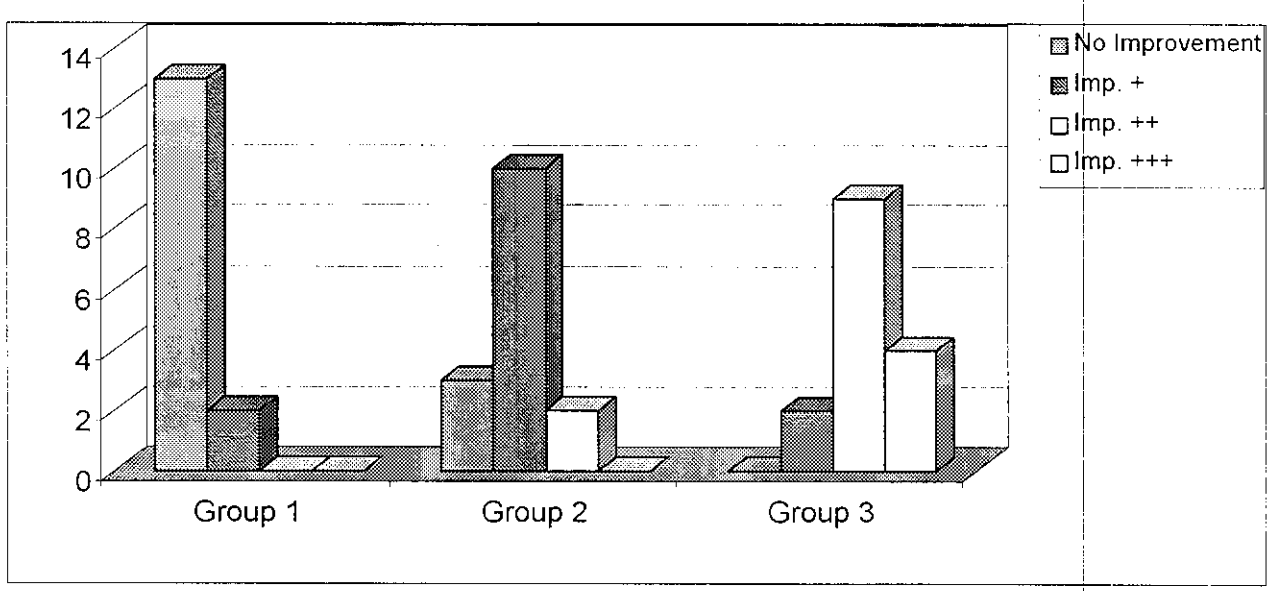


Fig. 3: Improvement of gait of the three investigated groups after treatment

DISCUSSION

The results of the present study suggests that myofascial release is the most effective technique in increasing excursion of ankle dorsiflexion in chronic burned tenoachilles. Less effects were observed followed ultrasonic application. Insignificant effect was recorded after application of autopassive exercises only.

Effects of ultrasonic

When ultrasound waves are absorbed in the tissues, there will be immense mechanical forces working in the tissues which cannot be compared with any other physical agent[19,22]. The alternation of positive and negative pressures at the frequency of the machine causes the micromassage effect of ultrasound[3,19]. The following biological effects are occured[3, 23]:

Loosening of the microscopic cell structure; and friction, which will produce a thermal effect; oscillation of particles in a fluid medium; and acceleration of the diffusion processes across the cell membrane; intracellular massage; breakdown of complex, biochemically active molecules; depolymerisation of proteins, especially those which are found in nerve, muscle and collagen cement; and reversible decrease of viscosity of intra- and extracellular colloidal substances.

According to Sullivan, any medium exposed to ultrasound will undergo heating proportional to the energy absorbed, the time insonated, and the specific frequency of the machine[19]. A tissue volume of 50 mm depth heats up with a speed of 0.2
any energy of 0.1 watts per minute is applied[22].

Gallugher[23] proposed that the friction caused by the micromassage effect of ultrasound causes production of heat in the tissues[3]. As an intact blood supply is generally operating, there is a constant dissipation of any increase of temperature. The greatest advantage is that deep-seated areas can be effectively heated, as there is no loss of energy in the skin and subcutaneous fascia.

Owing to the mismatch of impedance at the bone-muscle interface, there is reflection, and some shear waves occur which then cause increased heating effects around a joint or bone[22,23].

On the other hand Ward et al. concluded that the effect of range of motion on patients with scar tissue followed burn are not likely to improve from ultrasound treatment at the protocol parameters of their study[25].

Effects of Myofascial Release (MFR)

The Golgi Tendon Organ (GTO) is centrally involved in the process[2,6]. John and Barnes mentioned that GTO pervade all soft tissues including joints, structures, fascial sheaths and aponuroses[6]. Since GTO are either
l plasticity,
they readily respond to outside forces, such as manual maneuvers. They can easily assume new behaviors either normal or pathologic[6,13]. Using manual forces, release maneuvers permit GTO to return to more normal firing patterns, at least for a short time[17,20]. Effects occur as myofascial tightness and muscle spasm are released[20]. Slow carefully directed soft tissue loading can overcome many of these effects assuming massive neural and other soft tissue damage which have not occurred[17,21]. Although there is no direct evidence at present, it was assumed that such loading evokes myotatic (clasp-knife) reflexes[6,10].

The first (control) group showed insignificant improvement in range of motion or gait. This might be due to the presence of pain which might increase spasm of muscle and restriction

of fascia followed the application of the procedure[6,10,12].

CONCLUSION

It can be concluded that MFR and ultrasonic respectively are able to increase ROM of the ankle dorrsifesion in chronic burnt tendo Achilles.

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الملخص العربي

مقابلة الموجات فوق الصوتية وانفراج النسيج العضلي الضام على المدى الحركي للثني لأعلى لمفصل الكاحل في حروق العرقوب المزمنة

هدف الدراسة الحالية هو بحث مقارنة تأثير استخدام الموجات الفوق صوتية وانفـراج النسيج العضلي الضام في حروق العرقوب المزمنة. خمسة وأربعون مريضا تطوعوا في الدراسة الحالية يعانون من حرق مزمن بالعرقوب من النوع الثاني السطحي . تـم تقسيم المرضى عشوائيا إلى ثلاثة مجموعات متساوية. تم علاج المجموعة الأولى بالتمارين القهرية باستخدام وزن الجسم والثانية تم علاجها بالموجات الفوق صوتية مع التمارين القهرية باستخدام وزن الجسم. تم علاج المجموعة الثالثة باستخدام انفراج النسيج العضلي الضام مع نفس التمارين السابقة وذلك لمدة اثنا عشرة جلسة بمعدل ثلاثة جلسات أسبوعيا. وقد جاءت نتائج الدراسة بتقدم المجموعة الثالثة في التأثير الإيجابي على حركة مفصل الكاحل وتعقبها المجموعة الثانية حيث كان متوسط المدى الحركة قبل العلاج في المجموعة الثالثة ٥٣° , ٣٦° والثانية ٨٧, ٣٩° وبعد العلاج ٥٣, ٤٦° في الثالثة و٤٧, ٤٥° في المجموعة الثانية. وحدث تقدم طفيف في المجموعة الأولى. وكانت النسبة المئوية للتقدم كالآتي ٥,٦٦% في المجموعة الأولى، ١٥,٦% وفي الثانية، ٢٩,٦% في الثالثة. وقد تحسنت حالة المشي في المجموعة الثالثة حيث أصبحت طبيعية في ٢٦,٦٧% من الحالات ومتقدمة بدرجة عالية في ٦٠% من الحالات بينما كان التحسن في الثانية ١٣,٣٣% ولم يحدث تحسن ملحوظ في المجموعة الأولى. وقد يرجع هذا التقدم في المجموعة الثالثة لتأثير انفراج النسيج العضلي الضام على وتر عضو الجولجاي الذي يؤدي إلى انفراج النسيج واستطالة العضلة. وكذلك في المجموعة الثانية يرجع التقدم إلى التأثير الميكانيكي بالتدليك العميق والتسخين الذي يحدث عقب تطبيق الموجات الفوق صوتية. ويرجع عدم التقدم في المجموعة الأولى لوجود رد فعل الألم عند المريض الذي يحاول زيادة المدى الحركي فينتج عن ذلك تقلص العضلة وقصر النسيج العضلي الضام وبالتالي عدم القدرة على زيادة المدى الحركي.