



EXTRACORPOREAL SHOCKWAVE THERAPY IN MANAGEMENT OF MUSCLE TIGHTNESS

Physiotherapy

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ABSTRACT

Thirty healthy individuals with calf tightness were included in this study who were randomly allocated into three groups (ESWT, stretching and ESWT with stretching). The study aimed at comparing the effectiveness of ESWT on muscle tightness, static strength and myofascial trigger points. The effects were compared by ankle dorsiflexion ROM through weight-bearing lunge position using distance-to-wall technique and in non-weight bearing position using goniometer. Pain and static strength of calf muscle were measured using a seated calf-raise machine and f-meter respectively. The assessments were done before intervention, immediately after the intervention and at the end of 4th week after the 3week intervention. The result demonstrated that ESWT group and ESWT with stretching group demonstrated an increase in ROM and significant improvements were achieved in the mean intensity of trigger points when compared to the stretching group.

KEYWORDS

Extracorporeal Shock Wave Therapy, Calf Tightness, Myofascial Trigger Point, Static Strength, Lunge test, Calf flexibility

Introduction

Limited ankle dorsiflexion (DF) ROM can lead to the injuries of lower extremity including plantar fasciitis, Achilles tendinopathy, tibial pain, IT band syndrome and patellofemoral pain syndrome. Lack of flexibility of the triceps surae is one of the limiting factor of ankle DF. Increasing evidence suggest that extracorporeal shock wave therapy (ESWT), which has proved to be effective in the treatment of musculoskeletal injuries, has been also proposed for the treatment of spastic muscles. Considering the effect of shockwave in the treatment of tendon pathologies which is carried out by the biological mechanism of electrotransduction, it may also be assumed that the reduction in spasticity post shockwave therapy might be specifically due to its direct action on fibrous tissues by a reduction in the stiffness of the intramuscular connective tissue and by a change in the rheological properties of chronically hypertonic muscles.²

Also, extracorporeal shockwave therapy has become one of the best investigated treatment modalities for various conditions including myofascial pain syndrome as it plays a major role in desensitization. Owing to the direct effect of ESWT on muscle and intramuscular connective tissues as seen on spasticity, it can be speculated that it would also be effective in treating healthy individuals with muscle tightness. Therefore the main objective of this study is to compare the effect of ESWT on calf tightness, static strength and myofascial pain syndrome with stretching exercise.

Methodology

Participants:

The research was conducted at A+ Orthopaedic and Sports Med Centre with STORZ Medical ESWT machine. Thirty healthy individuals with calf tightness were recruited. The inclusion criteria were 20-45 years of age. The participants were excluded from the study if they had history of receiving extracorporeal shock wave therapy or performing any stretching exercise within 3 months from the day of screening, consumed any kind of medication such as muscle relaxant, NSAIDs, muscle relaxations that could alter the results of the study, presented with any coagulopathy disorder, calf tightness resulting from any central nervous system disorder, presented with any kind of skin ulcer or any open wound, had any orthopaedic condition such as fracture or surgery or presented with any cognitive impairment. Prior to treatment patients were verbally informed of the study, and signed consent forms were obtained from all patients, following a detailed physical examination was completed for each patient.

Procedure:

The selected subjects were randomly divided into three groups based on convenient sampling method: Group A (n=10) i.e is the ESWT group, Group B (n=10) i.e the stretching group and Group C (n=10) i.e

the stretching and ESWT group. All the participants were examined for eligibility and prior to the commencement of the session the ROM of the participants in weight bearing and non-weight bearing position was assessed along with the pressure pain threshold and static strength.

Extracorporeal shockwave therapy and stretching exercise:

The participants receiving shockwave only and shockwave along with stretching exercise received three sessions of shockwave each week on both the calf muscle. The participants received a total of 2000 impulses on each calf muscle in prone position with a repetition frequency of 5 Hz. A energy flux density of 0.074mJ/mm² was applied without the use of any kind of anaesthesia or analgesic drugs. The participants who were included in the stretching exercise only group and who received stretching along with ESWT had to perform the stretching exercise for 12 minutes a day. The protocol was to be followed for five days a week for a duration of three weeks. Calf muscle stretching in the weight bearing lunge position was used alternately where the position was to be maintained for 1 minute, which was followed by a 10 sec hold and a repetition of five sets.

Assessments:

The assessments were done before intervention, immediately after the intervention and four weeks after the completion of the three weeks protocol. One standard goniometer was used to measure the ankle joint range of motion in degrees in non-weight bearing position. Also the weight bearing lunge position was used to measure the ankle dorsiflexion ROM with the help of distance-to wall technique.⁴ For the assessment of pressure pain threshold, F-meter was used which was applied manually over the taut band in order to measure the minimum pressure that induces pain. With the participant positioned in a seated calf raise machine, the maximum isometric force (MIF) during a unilateral isometric calf raise was measured for static strength.⁶

Data Analysis

The statistical analysis was done by the statistician using excel spread sheet. The mean and standard deviation was calculated to compare the demographical variables. Two-way ANOVA was applied to compare statistical differences between baseline, at 3rd week and at 4th week after the 3 week intervention.

Results

Table 1:

VARIABLES	ESWT (N=10)	COMBINED (n=10)	STRETCHING (n=10)
age	26.3±5.06	23.6±4.14	24.7±5.03
BMI	23.52±5.08	23.15±4.82	22.46±3.34

General characteristics of subjects

Thirty healthy individuals (15 men and 15 women) were enrolled in the study with the mean age and mean BMI were 24.87±4.73 and 23.04±4.36, respectively. There was no significant difference between the age and BMI among the considered group.

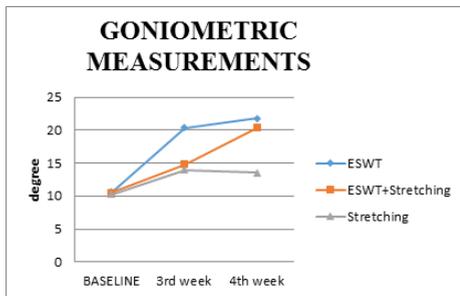
Table 2:

Column1	BASELINE	3rd week	4th week
Goniometric measurements			
ESWT	10.6±1.98	20.3±2.40	21.8±3.28
ESWT+Stretching	10.55±2.76	14.8±3.00	20.3±3.35
Stretching	10.3±1.59	13.95±1.72	13.5±1.84
lunge test			
ESWT	10.15±2.86	13.4±2.92	13.85±3.54
ESWT+Stretching	10.6±2.69	14.8±3.00	15±3.00
Stretching	9.9±1.16	12.85±1.13	12.7±1.07
Static Strength			
ESWT	30.01±10.18	34.65±10.27	35.35±14.44
ESWT+Stretching	29±14.96	35.35±8.01	30.1±13.26
Stretching	37.75±10.45	35.00±14	33.6±11.93
F-meter			
ESWT	15.505±6.45	23.81±7.32	29±5.25
ESWT+Stretching	13.09±5.44	23.45±7.07	23.9±7.94
Stretching	26.08±9.73	26.37±9.40	27.03±8.93

Changes in assessment in each group

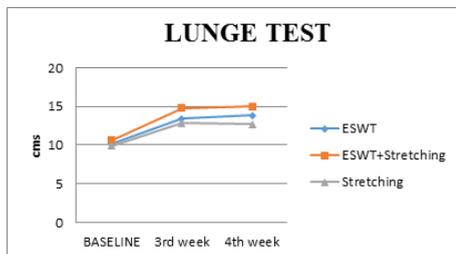
ESWT, extracorporeal shock wavetherapy
 Values are mean±SD unless otherwise indicated
 P<0.05 compared with baseline.

Figure 1:



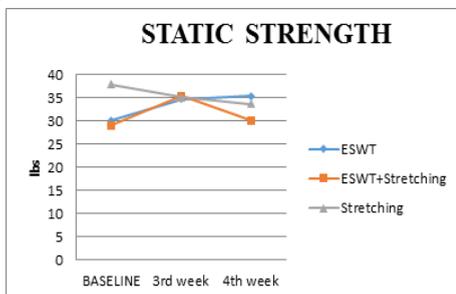
Comparison of goniometric measurements (flexibility in non-weight bearing position) between the three groups

Figure 2:



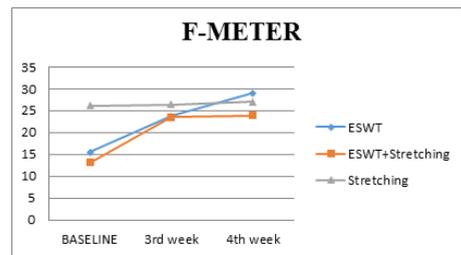
Comparison of lunge test (flexibility in weight bearing position) between the three groups.

Figure 3:



Comparison of static strength between the three groups.

Figure 4:



Comparison of myofascial pain using F-meter between the three groups.

Significant results were observed for goniometric measurements, lunge test (p<0.05) in group 1(ESWT), group 2(combined group), group 3(stretching) at 3rd week and at 4th week after the 3week intervention. However, the results for static strength were insignificant for all the three groups and the results for F-meter were significant in only group 1(ESWT) and group 2 (ESWT+stretching).

Discussion

In this study, the effects of extracorporeal shock wave was observed on muscle tightness, myofascial pain and static strength of the calf muscle. There are a limited number of studies on the effect of shockwave therapy in the treatment of musculoskeletal problems. Researches suggest that a decrease in the spinal excitibility can be one possible mechanism of action of shockwave therapy. However, some authors suggest that the mechanism of action of shockwave on muscles are similar to that of the underling action of ultrasound on muscle.⁷ There are many studies which have been proposed on the effect of stretching on muscle tightness which attribute to the increase in muscle tolerance to stretching exercise. It has also been suggested that stretching can be used as an adjuvant in reducing muscle tightness and increasing joint range of motion.¹

The current study also investigated the effect of muscle strength assessment along with the increase in active range of motion of ankle joint. The static strength of the calf muscle was observed at both baseline and immediately after the intervention and no significant results were obtained which indicates the presence of a similar nature of elasticity in the musculotendonous unit. Researchers suggest that with the support of the viscoelastic property of soft tissue that repetition of motion will thereby lead to a decreased stiffness and limited peak force. There are reports which demonstrate the effect of shockwave in increasing the strength by the application of shockwave on pathological areas as the decrease in pain in that area facilitated increases strength.⁸

In this study, the pressure pain threshold after the 3 week intervention of extracorporeal shockwave therapy showed statistically significant results. However, there were no changes in the pressure pain threshold of the individuals in the stretching group. Additionally, when the follow up was taken in the 4th week, the results were maintained which suggest that extracorporeal shockwave is efficient in reducing myofascial pain syndrome in healthy individuals. Studies suggest that the application of shockwave in injured areas, promote formation of new blood vessels along with stimulation of recovery of tissue recovery, it also facilitates removal of waste material that may be a cause of the pain.⁵

Limitations of our study include small sample size and short treatment time with no follow up to know the long lasting effect. Therefore, this study can be extensively used in near future by enrolling large sample size and the effectiveness of the intervention can be assessed with a follow-up period of 6 months or more. Further studies can be conducted to assess the effect of shockwave therapy on strength of the muscle treated and better instrumentation can be used for assessment of different variables.

It conclusion, each ESWT and stretching decreased the tightness of calf muscle immediately after the intervention and there was no significant difference in the static strength of the muscle post intervention. Also, there was significant decrease in the pressure pain threshold after the 3-week intervention using extracorporeal shock wave therapy. While shockwave when combined with stretching exercise showed significantly better results when compared to stretching and shockwave alone

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