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Research Article

Efficacy of Low-Level Laser Therapy with Myofascial Release in the Management of Tennis Leg

Yeenang Bagang¹, Natasha Verma², Jeyakumar^{*3}, Thillaivignesh⁴, Sedhu Nivas⁵

¹Post Graduate Student, Department of Physiotherapy, Garden City University, Bangalore, Karnataka

²Assistant Professor, Department of Physiotherapy, Garden City University, Bangalore, Karnataka

^{3*}Professor, Research Supervisor, Department of Physiotherapy, Garden City University, Bangalore, Karnataka

⁴Assistant Professor, Department of Physiotherapy, Garden City University, Bangalore, Karnataka

⁵Assistant Professor, Department of Physiotherapy, Garden City University, Bangalore, Karnataka

Background: ‘Tennis Leg’ is an injury commonly seen among sports person and also called as gastrocnemius strain. “Tennis Leg” refers to limited or full tear of medial part of muscle in gastrocnemius. In partial tear there is a limited tear of a part of musculotendinous junction and the tear of whole head of medial gastrocnemius is a complete tear. It results from restricted contraction of gastrocnemius muscle with sudden extension of knee and forceful dorsiflexion with overstretching of the muscle resulting in disruption of the fibres from the aponeurosis. MFR is a Manual therapy technique used commonly. MFR consist of use of minimal load, long stretch, that helps to restore optimum length of the tissue, decrease pain and enhance functionality. MFR can be used for tennis leg as MFR helps in eliminating the musculoskeletal pain. LLLT can be used for treatment of tennis leg as it has many bioavailable effects, it activates the electron transport chain, increase ATP synthesis and thus causes macrophages, fibroblast and lymphocyte activities.

Objective: The objective of the study is to find the efficacy of LLLT with Myofascial Release in Tennis Leg.

Method: Two groups, control and experimental group were taken. For control groups conventional treatment was given and for experimental group foam roller and laser was given. Pre-test and Post-test values were compared at the end of the session (4-weeks).

Results: A significant difference was observed between pre-test and post-test LEFS scores in Group A ($p=0.0007$). A significant difference was observed between pre-test and post-test NPRS scores in Group A ($p=0.0004$).

Conclusion: Therefore, we concluded that, the changes in LEFS and NPRS scores after post-test slightly higher in Group A as compared to Group B. which means the group A which involved LLLT with MFR was more effective than the control group.

Keywords: Tennis leg, gastrocnemius strain, calf pain, gastrocnemius stiffness, foam roller, Myofascial release, LLLT

INTRODUCTION

‘Tennis Leg’ is an injury commonly seen among sports person and also called as gastrocnemius strain. “Tennis Leg” refers to limited or full tear of medial part of muscle in gastrocnemius. In partial tear there is a limited tear of a part of musculotendinous junction and the tear of whole head of medial

Correspondence should be addressed to
Jeyakumar; Email: jeysubikshaa@gmail.com

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gastrocnemius is a complete tear.⁽¹⁾ It results from restricted contraction of gastrocnemius muscle with sudden extension of knee and forceful dorsiflexion with overstretching of the muscle resulting in disruption of the fibres from the aponeurosis.⁽¹⁾⁽²⁾ It is most common in athletes between 22 to 28 years of age, mostly seen in men than in women and with chances of recurrent in approximately 19% to 31% of cases. Tennis leg occur mostly in people playing racquet sport, running, skiing and jumping. The name tennis leg came in existence as it was first diagnosed in a Tennis player by Powell in 1883.⁽³⁾ Gastrocnemius muscle is the outermost muscle in the calf that has two heads, medial head and lateral head. The lateral head originates from the posterior femoral condyle and medial head from the medial condyle, both the heads combine and form an aponeurosis, which then combines with the soleus aponeurosis to form Achilles tendon. Tear of the medial head is described as tennis leg.⁽⁴⁾

Clinical findings include of burning pain and swelling in the calf, the pain aggravates as the foot is passively moved into dorsiflex and sometimes the player complains of a “pop” sound, Weight bearing is painful on the affected leg and tenderness on touching the calf.⁽⁵⁾ MFR is a Manual therapy technique used commonly.⁽⁶⁾ MFR consist of use of minimal load, long stretch, that helps to restore optimum length of the tissue, decrease pain and enhance functionality.⁽⁶⁾ MFR can be used for tennis leg as MFR helps in eliminating the musculoskeletal pain. There are theories on how MFR application assist pain reduction:

1. The gate control theory- pressure travels quicker than the pain stimuli, results in delaying of pain stimuli reaching the brain, thus closing the gate to the brain.
2. Interpersonal attention- refers to the hands-on-personalised massage received by the person. It gives a calming effect that decrease the sensitivity to pain.
3. Parasympathetic response of autonomic nervous system: when parasympathetic response is stimulated there is decreased flow of stress hormones, anxiety, depression and pain.
4. Serotonin: disrupts the travel of noxious stimuli to brain.⁽⁷⁾

There are passive and active MFR. In passive MFR, there is application of minimal pressure while patient remains passive during treatment and in active MFR, patient uses their own muscle contraction to relax.⁽⁶⁾ Self MFR is most commonly practiced MFR by the patients. In SMR the patient can alter the pressure according to their convenience, using a tennis ball or a foam roller.

Foam rolling can result in increased ROM by stimulating hydration of tissues, and increased blood flow and temperature.⁽⁷⁾

The compressive myofascial release and the instrument assisted soft tissue mobilization (IASTM) are commonly used soft tissue mobilization. In Compressive myofascial release there is application of compression and holding the stretch to release the area. IASTM identifies and tends myofascial problems. Both the approaches are used for treating scar tissue, fascial bond, or any tightness in the Musculo tendinous area and also tends certain areas of restriction.⁽⁸⁾⁽⁹⁾ Both approaches follow similar concept in tending certain spots of restrictions, to free scar tissue, tend fascial bond, and lessen tautness in the musculotendinous area.⁽¹⁰⁾

Whereas, global changes like decrease in pain sensitivity and increase in parasympathetic activity results in tolerance to stretch during passive joint movement.⁽¹²⁾

LLLT is a continuous laser or light emitting diode. It aids in stimulating tissue repair and minimising the inflammation. Also called as ‘Cold Laser Therapy’ as it does not increase the temperature in tissues.⁽¹³⁾ It is a light source intervention acting through non-thermal or photochemical reaction in cells. It includes laser acupuncture which follow focused irradiation at specific points or acupuncture points with low intensity laser.⁽¹⁴⁾ LLLT can be used for treatment of tennis leg as it has many bioavailable effects, it generates the electron transport chain, increase ATP synthesis and thus causing macrophages, fibroblast and lymphocyte activities. LLLT cause increased circulation in the injured area helping in relieving pain. Substances producing pain is drained out through vascular flow, which is effective for reducing the burning pain in tennis leg patients.⁽¹⁵⁾ According to various studies, it suggests that pain reduction following LLLT happens due to decrease in oxidative stress and oedema formation. LLLT also affects serotonin and endorphin release diminishing the pain signals. Light emitted during the procedure reacts with Cytochrome C Oxidase increasing ATP production and reducing reactive oxygen species levels, thus helping in cell inflammation and death.⁽¹³⁾ The effectiveness of LLLT depends on various parameters like Wavelength, Penetration, Dose, Time of application, Power density, Pulse repetition rate and Treatment.

METHODOLOGY

- The study is a randomized control trial comprising Group A (experimental group) comprising laser and MFR with foam roller and

Group B (control) comprising of rest and stretching exercise.

- Based on the inclusion criteria subjects will be taken.
- Both groups underwent pre-test assessment for pain using a Numerical Pain Rating Scale, and functional abilities using LEFS respectively.
- Post-test assessment for the outcome measures will be taken.

Source of Data: After signing the consent form, the study was conducted at the GCU Physiocare and GCU university.

Study Design

- Pre-test and Post-test design.
- Experimental study

Sample size: 32 subjects.

Sampling Technique: Convenience Sampling.

Inclusion Criteria

- Age group 25-35 years
- Pain in the medial side of gastrocnemius
- Both male and female
- Subjects willing to take the treatment.

Exclusion Criteria

- Recent fractures of leg.
- Hyper sensitivity to touch.
- Age below 25 years of age.

Outcome measures

- Numeric Pain Rating Scale (NPRS)
- Lower extremity functional scale (LEFS)

Materials required: Foam roller, Laser. Goggles

TREATMENT PROTOCOL

Subjects who fulfilled the inclusion and exclusion criteria were randomly allocated into two groups A and B. Individuals selected for the study were assessed prior and post intervention program with outcome measures like NPRS and LEFS.

Group A (experimental group)

Procedure

Both subjects and the therapist will be wearing goggles for this intervention. A LLLT will be used for the study with output power of less than 0.5 watts and wavelength between 780nm -950nm and pulsed mode. The subject will be asked to lie in prone position with a pillow under his leg. The therapist will be sitting at the end of the bed by the affected side leg in chair. Subject will be irradiated by laser at point of pain or tender point. Laser Irradiation will be given for about 6 minutes for 3 days a week day for 4 weeks.

The subjects were asked to do self- myofascial release using a foam roller of 3 sets of 1 minute with a 30 sec rest in between each set. Each set consisted of 20 movement cycles, stop if pain increases. Proper instructions will be given to the subjects on how to use the foam roller for gastrocnemius.

The subject will in long sitting position. Then the subject will take the foam roller and place it under the calf muscle of the affected leg with the unaffected leg on it. Now the subject will lift his glutes with both the hands placed on the ground and slowly roll over the foam roller in back-and-forth motion.

The subject will be asked to follow the protocol for 4 weeks.

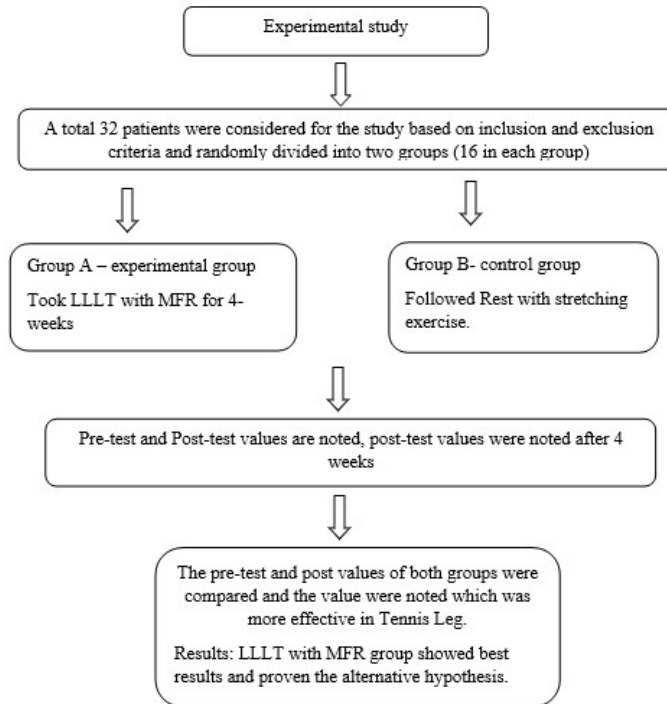
Group B (Control Group)

For this group rest and stretching exercise will be given for 4 weeks. The exercise protocol can be started after 2 to 3 days. They will be given proper instructions on how to do the exercises.

Procedure

For gastrocnemius muscle, the subject will be asked to stand in a lunge position and flex the knee of the leg in front keeping both the heels on the ground and stretching the knee of the affected side. For soleus muscle, the subject will be made to stand in a lunge position then lowering the knee until a stretch is felt on the calf. Both these exercises will be done daily for 3 repetitions with 30 second hold with 5 second rest in between for 4 weeks.

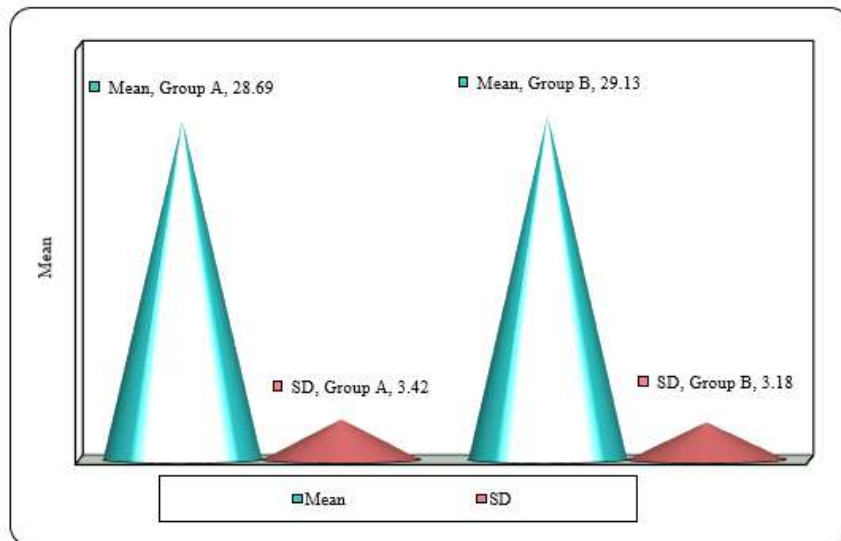
CONSORT CHART



DATA ANALYSIS

Table 1: Comparison of Group A and Group B with mean age by independent t test

Groups	n	Mean	SD	SE	t-value	P-value
Group A	16	28.69	3.42	0.85	-0.3747	0.7105
Group B	16	29.13	3.18	0.80		

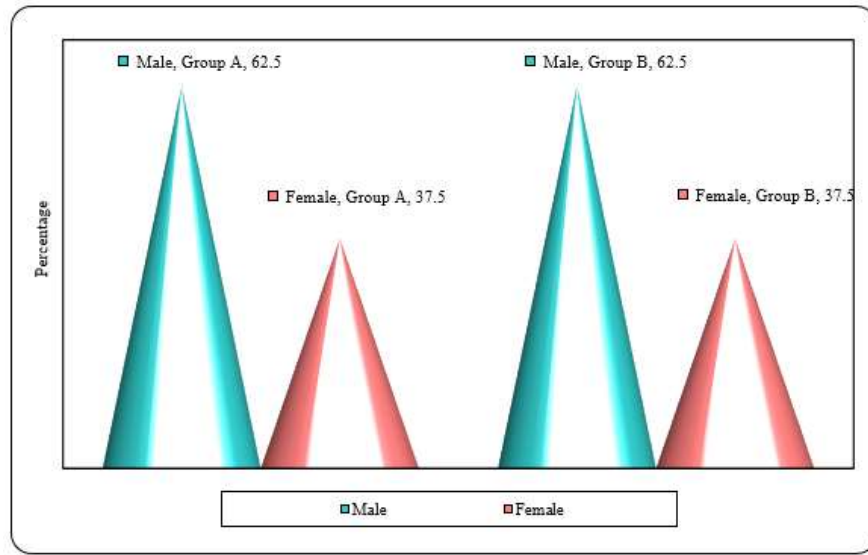


Graph 1: Comparison of Group A and Group B with mean age

Table 2: Comparison of Group A and Group B with gender

Gender	Group A	%	Group B	%	Total	%
Male	10	62.50	10	62.50	20	62.50
Female	6	37.50	6	37.50	12	37.50
Total	16	100.00	16	100.00	32	100.00

Fishers exact, P=10000



Graph 2: Comparison of Group A and Group B with gender
Table 3: Normality of pre-test and post-test scores of LEFS and NPRS in Group A and Group B by Kolmogorov Smirnov test

Variables	Times	Group A		Group B	
		Z-value	p-value	Z-value	p-value
LEFS	Pre-test	0.1690	0.2000	0.1180	0.2000
	Post-test	0.1110	0.2000	0.2212	0.0380*
	Difference	0.2360	0.0170*	0.1550	0.2000
NPRS	Pre-test	0.1970	0.0960	0.2390	0.0150
	Post-test	0.2050	0.0700	0.2200	0.0380*
	Difference	0.1700	0.2000	0.2680	0.0030*

*p<0.05

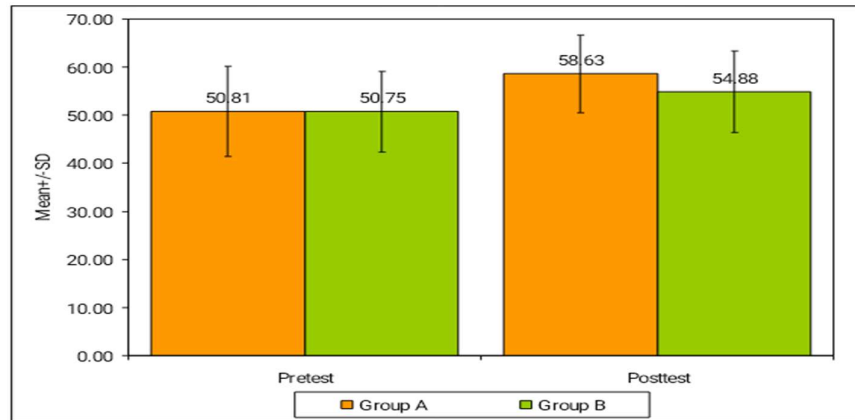
Note that, the pre-test and post-test scores of LEFS and NPRS in Group A and Group B not follow Normal distribution. Therefore, the non-parametric tests were applied.

Table 4: Comparison of Group A and Group B with pre-test and post-test scores of LEFS scores by Mann-Whitney U test

Time points	Group A			Group B			U-value	Z-value	P-value
	Mean	SD	Mean rank	Mean	SD	Mean rank			
Pre-test	50.81	9.40	16.31	50.75	8.35	16.69	125.00	-0.0942	0.9249
Post-test	58.63	8.07	18.69	54.88	8.47	14.31	93.00	1.3003	0.1935
Difference	7.81	5.48	20.38	4.13	2.75	12.63	66.00	2.3179	0.0205*

*p<0.05

- No significant difference is observed between Group A and Group B with pre-test LEFS scores ($Z=-0.0942$, $p=0.9249$). It means that, the pre-test LEFS scores are similar in Group A and Group B
- No significant difference is observed between Group A and Group B with post-test LEFS scores ($Z=1.3003$, $p=0.1935$). It means that, the post-test LEFS scores are significantly higher in Group A as compared to Group B.
- A significant difference is observed between Group A and Group B with changes in LEFS scores from pre-test to post-test ($Z=2.3179$, $p=0.0205$). It means that, the changes in LEFS scores from pre-test to post-test are significantly higher in Group A as compared to Group B.



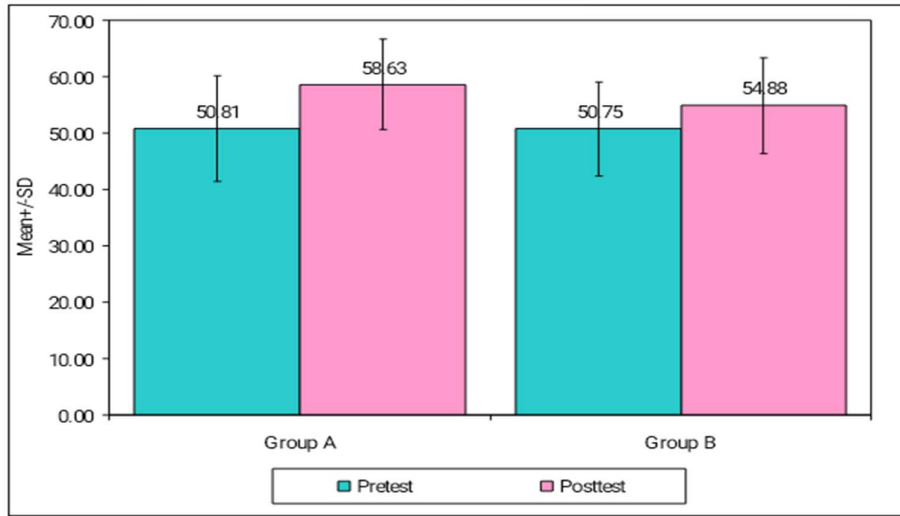
Graph 3: Comparison of Group A and Group B with pre-test and post-test scores of LEFS scores

Table 5: Comparison of pre-test and post-test with LEFS scores in Group A and Group B by Wilcoxon matched pairs test

Group	Time points	Mean	SD	Mean Diff.	SD Diff.	% of change	Z-value	P-value
Group A	Pre-test	50.81	9.40					
	Post-test	58.63	8.07	-7.81	5.48	-15.38	3.4079	0.0007*
Group B	Pre-test	50.75	8.35					
	Post-test	54.88	8.47	-4.13	2.75	-8.13	3.4078	0.0007*

* $p<0.05$ indicates significant

- A significant difference was observed between pre-test and post-test LEFS scores in Group A ($Z=3.4079$, $p=0.0007$). It means that, the post-test LEFS scores are significantly higher as compared to pre-test LEFS scores in Group A. in another words, a significant of 15.38% changes was observed in LEFS scores after post-test in Group A.
- A significant difference was observed between pre-test and post-test LEFS scores in Group B ($Z=3.4078$, $p=0.0001$). It means that, the post-test LEFS scores are significantly higher as compared to pre-test LEFS scores in Group B. in another words, a significant of 8.13% changes was observed in LEFS scores after post-test in Group B. Therefore, we concluded that, the changes in LEFS scores after post-test slightly higher in Group A as compared to Group B.



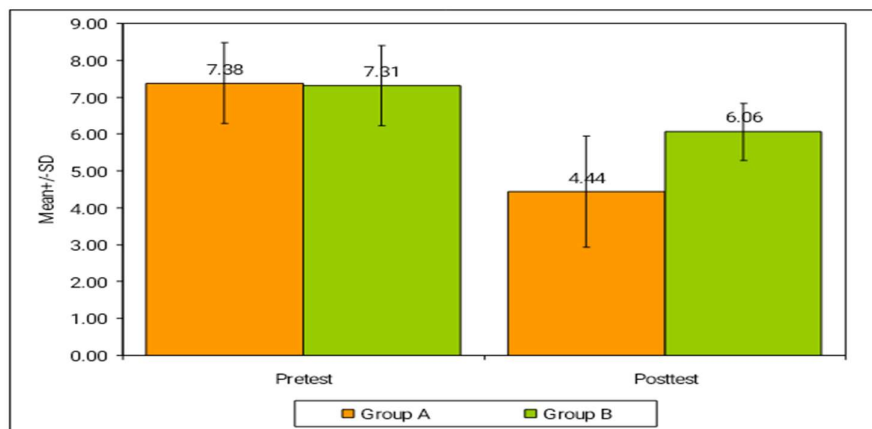
Graph 4: Comparison of pre-test and post-test with LEFS scores in Group A and Group B

Table 6: Comparison of Group A and Group B with pre-test and post-test scores of NPRS scores by Mann-Whitney U test

Time points	Group A			Group B			U-value	Z-value	P-value
	Mean	SD	Mean rank	Mean	SD	Mean rank			
Pre-test	7.38	1.09	16.78	7.31	1.08	16.22	123.50	0.1508	0.8802
Post-test	4.44	1.50	11.59	6.06	0.77	21.41	49.50	-2.9397	0.0033*
Difference	2.94	1.39	22.06	1.25	0.68	10.94	39.00	3.3355	0.0009*

*p<0.05

- No significant difference is observed between Group A and Group B with pre-test NPRS scores (Z=0.1508, p=0.8802). It means that, the pre-test NPRS scores are similar in Group A and Group B
- A significant difference is observed between Group A and Group B with post-test NPRS scores (Z=-2.9397, p=0.0033). It means that, the post-test NPRS scores are significantly lesser in Group A as compared to Group B.
- A significant difference is observed between Group A and Group B with changes in NPRS scores from pre-test to post-test (Z=3.3355, p=0.0009). It means that, the changes in NPRS scores from pre-test to post-test are significantly higher in Group A as compared to Group B.



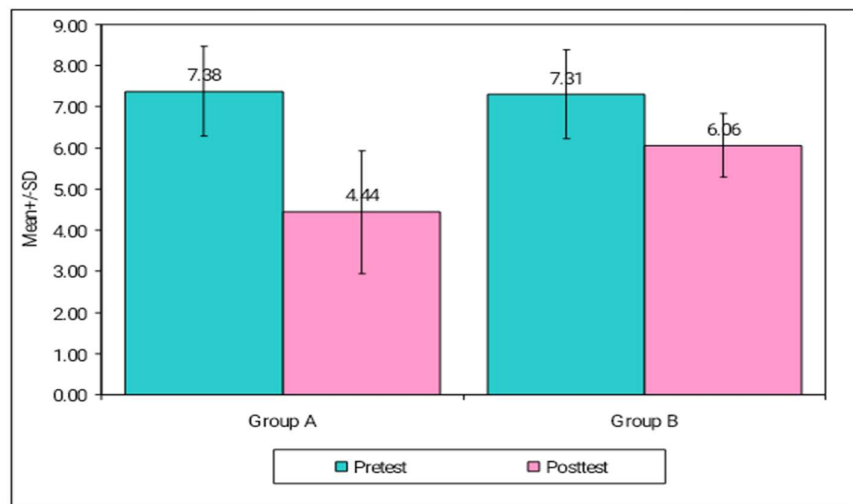
Graph 5: Comparison of Group A and Group B with pre-test and post-test scores of NPRS scores

Table 7: Comparison of pre-test and post-test with NPRS scores in Group A and Group B by Wilcoxon matched pairs test

Group	Time points	Mean	SD	Mean Diff.	SD Diff.	% of change	Z-value	P-value
Group A	Pre-test	7.38	1.09					
	Post-test	4.44	1.50	2.94	1.39	39.83	3.5162	0.0004*
Group B	Pre-test	7.31	1.08					
	Post-test	6.06	0.77	1.25	0.68	17.09	3.2958	0.0010*

*p<0.05 indicates significant

- A significant difference was observed between pre-test and post-test NPRS scores in Group A (Z=3.5162, p=0.0004). It means that, the post-test NPRS scores are significantly higher as compared to pre-test NPRS scores in Group A. in another words, a significant of 39.83% changes was observed in NPRS scores after post-test in Group A.
- A significant difference was observed between pre-test and post-test NPRS scores in Group B (Z=3.2958, p=0.0010). It means that, the post-test NPRS scores are significantly higher as compared to pre-test NPRS scores in Group B. in another words, a significant of 17.09% changes was observed in NPRS scores after post-test in Group B. Therefore, we concluded that, the changes in NPRS scores after post-test are significantly higher in Group A as compared to Group B.



Graph 6: Comparison of pre-test and post-test with NPRS scores in Group A and Group B

RESULTS

The data were analysed using SPSS software. Suitable statistical tests were used based on the distribution of the data. 32 subjects fulfilling the inclusion criteria completed the pre-test and post-test assessment were noted and performed the statistical analysis.

Comparison of pre-test and post-test with LEFS scores in Group A and Group B by Wilcoxon matched pairs test was done. A significant difference was observed between pre-test and post-test LEFS scores in Group A (p=0.0007).A significant of 15.38% changes was observed in LEFS scores after post-test in Group

A.A significant difference was observed between pre-test and post-test LEFS scores in Group B (p=0.0001).A significant of 8.13% changes was observed in LEFS scores after post-test in Group B. Therefore, we concluded that, the changes in LEFS scores after post-test slightly higher in Group A as compared to Group B. Comparison of pre-test and post-test with NPRS scores in Group A and Group B by Wilcoxon matched pairs test. A significant difference was observed between pre-test and post-test NPRS scores in Group A (p=0.0004).A significant of 39.83% changes was observed in NPRS scores after post-test in Group A.A significant difference was observed between pre-test and post-test NPRS scores in Group B (p=0.0010). A significant of 17.09%

changes was observed in NPRS scores after post-test in Group B. Therefore, we concluded that, the changes in NPRS scores after post-test are significantly higher in Group A as compared to Group B.

DISCUSSIONS

The present study investigated gastrocnemius stiffness (TL) before and after an intervention in foam roller and control groups. The results showed a significant decrease in gastrocnemius stiffness and a significant increase in ankle dorsiflexion ROM in foam roller group, with no significant change in control group.

According to Bhatia, M, et. Al, Tennis leg results from partial or complete tear of the musculotendinous junction of the medial head of gastrocnemius and presents with acute onset of pain and swelling in the calf. The pain and tenderness in the calf increases with passive dorsiflexion of ankle joint. ⁽¹⁾

Calf strain is also known as “tennis leg” as it is commonly occurred in that sport. However, Calf strains are not limited to tennis and also occur in many other sports like American football. ⁽¹⁹⁾

According to Froimson AI, et. al, A mix of hyperextension of knee and ankle dorsiflexion is prone to producing this lesion. In fully extended knee and the fully dorsiflexed ankle, there is increased stretch in gastrocnemius, adding enough stress on the elastic components of muscle resulting in a tear. ⁽²⁰⁾

According to David N. Taylor, et. Al, LLLT has clinical and physiological effects in management of various conditions, like anti – inflammatory, analgesic, and healing effects. It is also believed that the mitochondria of the cells are affected by LLLT, that results in higher adenosine triphosphate production, reactive oxygen species changes, and induce transcription factors that stimulates healing. ⁽¹⁶⁾

In a study by Chang TT et. al, it revealed that if the muscle stiffness is increased there can be decreased ROM and diminished function, which results in risk of injury in ankle joint in both acute and chronic conditions. MyotonPRO was used to measure the stiffness in MG and LG with the ankle in a neutral position. SMR is a treatment method done by self where there is application of pressure to soft tissue to minimise the stiffness. The Foam Roller, is a device mostly used as self-myofascial release, in sport setting and physical therapy. The use of FR does not diminish the muscle strength and jump height, also enhances sprint performance, remove muscle pain, and enhances neuromuscular efficiency. ⁽¹¹⁾

Akane Yoshimura, et. al, mentioned in his study that use of FR on the calf resulted in an improvement in ankle dorsiflexion ROM. As per this study, mechanical stimulation with the load and stretch used in FR method triggers a mechanical stimulation, which has neurological biomechanical, psychological and physiological effects, resulting in both global and local changes. In local changes, the tissues become softer as the blood flow, skin or muscle temperature increases, and there is reduced stiffness in tissue, termed as “thixotropy”. And in global changes there is increased tolerance to stretch during passive joint movement as a result of decrease pain sensitivity and increased parasympathetic activity. ⁽¹²⁾

Calf strain otherwise known as “tennis leg” as it found frequently in that sport. Tennis leg results from tear which can be complete or incomplete of the medial head of gastrocnemius and present with pain and swelling in the calf. The process of occurrence of the injury involves fully extended knee and fully dorsiflexed ankle, overstretching of the gastrocnemius, creating tension on the elastic components of muscle to cause tear.

The Foam Roller, a device very often used for self-myofascial release, helps in reducing stiffness and increasing ROM. As per this study, FR method triggers a mechanical stimulation, which has neurological biomechanical, psychological and physiological effects, resulting in both global and local changes. In local changes, the tissues become softer as the blood flow, skin or muscle temperature increases, and there is reduced stiffness in tissue, termed as “thixotropy”. And in global changes there is increased tolerance to stretch during passive joint movement as a result of decrease pain sensitivity and increased parasympathetic activity.

LLLT can be used for treatment of tennis leg as it has many bioavailable effects, it generates the electron transport chain, increase ATP synthesis and thus causing macrophages, fibroblast and lymphocyte activities. LLLT cause increased circulation in the injured area helping in relieving pain. Substances producing pain is drained out through vascular flow, which is effective for reducing the burning pain in tennis leg patients.

This study was conducted to analyse the effectiveness of LLLT with MFR using foam roller in individuals with TL. 32 subjects were divided into two groups, control group and experimental group. Laser and Foam roller was used for experimental group and for control group R.I.C.E followed by stretching exercise for gastrocnemius for 4 weeks. LEFS AND NPRS were

noted pre and post intervention after 4 weeks to see the results.

The result showed that compared to control group the experimental group showed best results in decreased pain and increased functional capacity.

CONCLUSION

The purpose of the study was to find the effectiveness of LLLT with MFR in Tennis Leg and compare the study with a control group receiving conventional treatment. The data analysis and results attained reveal that both the groups showed significant results post intervention. However, the experimental group showed higher significance post intervention when

compared to control group. Hence, the study can be concluded that the application of LLLT and MFR in Tennis Leg is more beneficial in reducing pain and improving functional activities.

Limitations

- The study was done on only age group between 25-35
- Subject included in the study were fewer
- Short follow up

Recommendations

- The study can be done on wider age group.
- Longer follow up programme

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