ORIGINAL ARTICLE

Effect of self-myofascial release on latent myofascial trigger points in physically active male individuals

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ABSTRACT

Self-massage techniques using foam rollers and massage sticks have gained popularity for enhancing athletic performance and recovery. This study evaluated the effectiveness of self-myofascial release (SMR) on latent myofascial trigger points (L-MTrPs) in the hamstrings and quadriceps. Fifty participants aged 19 to 25 were assessed for pain pressure threshold (PPT) and L-MTrPs. From this group, 30 participants with the lowest PPT values were randomly assigned to either a control group or an SMR group. The SMR group received foam rolling treatment twice weekly for six weeks, while the control group received no intervention. PPT and ultrasonographic measures were recorded before and after the treatment period. A one-way repeated measure design was used as a statistical technique to compare the repeated effect of the SMR intervention on L-MTrPs. Results showed significant improvements in PPT for the SMR group compared to the control group, indicating a reduction in pain sensitivity. The SMR group experienced marked improvements from baseline to the sixth week. These findings suggest that SMR can effectively reduce pain associated with L-MTrPs, potentially through changes in tissue properties, improved blood flow, or neurological effects. Despite promising results, the mechanisms behind these effects are not fully understood, and the study's findings need further validation. Additional research with larger sample sizes, standardized methods, and placebo controls is necessary to confirm the benefits of SMR and refine treatment protocols. Future studies should also explore optimal treatment parameters and the impact of SMR on other body regions and types of trigger points.
Keywords: Sport medicine, Athletes, Foam rolling, Myofascial pain syndrome, Musculoskeletal, Self-myofascial release.

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INTRODUCTION

During the past two decades, active self-massage treatments using by various instruments such as, foam rollers, roller massagers, sticks or balls, have rapidly gained popularity amongst elite and recreational athletes (Biscardi & Stroiney, 2021; Ferreira et al., 2022). It is well-respected in the strength and conditioning field for its ability to enhance the effectiveness of training and competition preparation, as well as for speeding up recovery after exercise (Behm & Wilke, 2019; Wiewelhove et al., 2019). Research evidence suggests that foam rolling improve myofascial health (Hendricks et al., 2020). Fascia plays a large role in musculoskeletal dynamics (Das et al., 2024). Healthy fascia leads to better quality of movement, while restricted fascia becomes a site of tension, diminishing functional movement capacity (Ajimsha et al., 2020; Anwar et al., 2024). The common fascia disorder is latent myofascial trigger points (L-MTrPs) (Das & Jhajharia, 2022; Wilke et al., 2018), these trigger points (TrPs), can be develop though any kind of physical activity (Benito-de-Pedro et al., 2019; Das, Jhajharia, Shukla, et al., 2023), and these MTrPs can negatively affect the sports performance as well as daily life activities (Das, Jhajharia, Ciocan, et al., 2023; ÖZTÜRK et al., 2022). There is insufficient scientific research elucidating about the effects of "*self-myofascial release*"(SMR) instruments in the treatment of TrPs (Behm & Wilke, 2019; Skinner et al., 2020).

Researchers utilised a multimodal approach that included the application of pressure on TrPs by clinicians and self-administered methods, as well as stretching exercises, and reported improvements in the lower extremity functional scale in six weeks after treatment. Due to the lack of a control group and the confounding of various treatments, it is impossible to draw definitive conclusions regarding the influence of self-release (Grieve et al., 2013). Wilke and his colleagues compared static compression and dynamic foam rolling to a placebo condition when applied to MTrP. In fact, static compression was the only treatment capable of alleviating discomfort (Wilke et al., 2018). Yet, presumably due to the small sample, the difference to the placebo control did not reach statistical significance. The treatment effect of foam rollers, particularly on pressure sensitivity, or pain, is largely unclear (Behm & Wilke, 2019; Hendricks et al., 2020). Most studies carried out rolling interventions according to different parameters, so that the treatment intensity, treatment duration and number of repetitions differed. To date, there is no optimal protocol of a rolling intervention to achieve the best possible results (Wiewelhove et al., 2019). In summary, although signs indicate that self-massage with rolling devices may reduce MTrP sensitivity, but more research is needed in order to definitely substantiate this claim. More importantly, although, manual pressure release seems to improve function and possibly pain, the question arises as to whether these effects actually stem from the release of myofascial adhesions, scar tissue or taut bands(Behm & Wilke, 2019).

Glänzel and his colleagues mention in their article that studies provide low certainty but the effect of SMR and L-MTrPs, therefore researchers recommended to conduct studies on SMR(Behm & Wilke, 2019; Glänzel et al., 2022; Kalichman & Ben David, 2017). According to research evidence myofascial research is still in its infancy; there is no clearance on the duration of treatments and breaks; there is no agreement on the type of roller to be used; there is no clear direction on the force to be applied on the tissue; the speed and frequency of rolling may vary from study-to-study; and the treatment frequency that should be repeated in one session are not always the same. So, due these uncertainties and discrepancies on the treatment methods/protocols and therapeutic effects, some authors affirm that the reported benefits are anecdotal in nature, making evidence-based practice difficult (Dębski et al., 2019). Additionally, to our knowledge, there is no available umbrella review on the effectiveness of SMR instruments on performance and recovery. Therefore, the aim of this investigation is to find out the effectiveness of SMR on L-MTrPs recovery.

MATERIALS AND METHODS

A randomized control study was conducted to comparing between SMR group and control group, which were afflicted with a L-MTrP in hamstring and quadricep muscles. It was hypothesized that SMR technique would reduce the pressure pain sensitivity, TrPs assessed by means of algometry and ultrasonography.

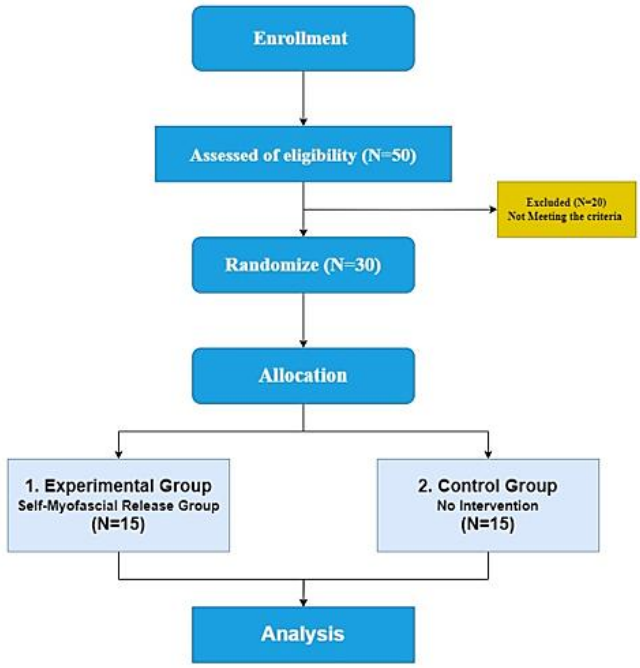

Figure 1. CONSORT study flow chart.

Participation
To execute this study, a total of 50 participants were randomly recruited from the Lakshmibai National Institute of Physical Education, Gwalior. The age of the chosen participants ranged from 19 to 25 years.

Measures
The selected cohort underwent assessments for pain pressure threshold (PPT), and Ultrasonography in lower extremity muscles. Subsequently, 30 subjects were purposefully selected based on their lower PPT values and ultrasonography result. The sample size was determined with the help of the G-power software (Version 3.1.9.7) (Cordeiro et al., 2022). The calculation was done by considering the following criteria: an effect size 0.40 (medium effect), an error probability (1-β) of .95 and an α error probability of .05, the number of groups 1, and number of measures given was 4, an estimated sample size of 15 participants in a group. Therefore, selected subjects were randomly assigned to two different groups: the control group (N = 15), and SMR group (N = 15). Written consent was obtained from the subjects prior to the collection of the necessary data. It was conducted according to the latest version of the Declaration of Helsinki (approval number: 392/1346/27, 22 February 2023).

Procedure
In this present study we used FPX 25 Wagner (FPX 25 Wagner Instruments, Greenwich, CT, USA) pressure algometer to measure PPT(Das, Jhajharia, Shukla, et al., 2023; H. Battecha et al., 2021). Pressure algometers are reliable for evaluating pain thresholds to detect MTrPs (Das, Jhajharia, Ciocan, et al., 2023),

and Samsung Medison V7 ultrasonographic device were used for ultrasonography. All participants were screened for L-MTrP in the Quadricep and hamstring muscles groups (Figure 2). The search, performed under the expert physiotherapist, the TrPs were identified according to Travell and Simons (David G. Simons et al., 1999; Wilke et al., 2018) criteria, which is located near the muscle belly. To confirm the presence of L-MTrPs the participants referred to an expert radiologist who was unaware to the results of the algometric diagnosis. The radiologist has more than 20 years of experience in clinical radiology and 15 years of experience in the ultrasonography of musculoskeletal diseases. L-MTrPS detection was based on the following criteria: (1) palpable taut band, (2) presence of a painful nodule within this taut band, (3) PPT of less than 25 lbs/cm^2 (Cordeiro et al., 2022), and (4) presence of focal hypoechoic (darker) areas with heterogeneous echotexture in ultrasonography (Figure 3). To ensure identical pre- and post-treatment measurements of MTrP sensitivity, each diagnosed MTrP was marked with a skin marker.

Figure 2. Measurement of pain pressure threshold with a pressure algometer.

Figure 3. Ultrasonography of latent myofascial trigger points.

The participants were randomly allocated to two groups, compression of the most sensitive L-MTrP using a foam roller in experimental group (N = 15), and control group with no intervention (N = 15). Randomization was performed by an independent investigator using BiAs 10.04 (Goethe University, Frankfurt, Germany).

Treatment

The foam rolling (FR) therapy was self-administered using a foam roller, which is commercially available. A foam roller is made of a layer of high-density ethylene vinyl acetate foam over a firm, inner plastic core. During the FR treatment, slow movements were used while constant pressure was put on the muscle's origin and insertion for 90 seconds for each muscle. The treatment was done on one side of the quadriceps and hamstrings. The foam rolling treatment was administered in the following way: Position of the subject: sitting on the floor with the foam roller positioned under the muscle group where TrPs are found. Apply pressure: use the arms to lift the body slightly off the ground and apply pressure (Figure 4) to the foam roller with the lower limb. Roll slowly back and forth over the muscle group, applying pressure to selected areas where L-MTrPs are found. Continue rolling: continue to roll back and forth over the muscle group for 90 seconds for each muscle. Move to other areas: repeat the process on other muscle groups, such as the hamstrings, and quadricep.

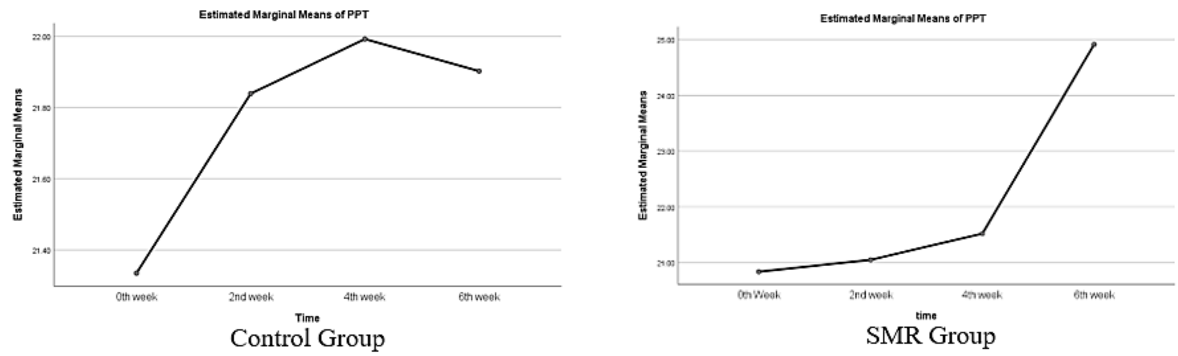

Figure 4. Marginal plot of the control group and SMR group.

Statistical analysis

The statistical analysis was performed using IBM SPSS (version 26.0.0) Mean and standard deviation was used to describe various average of the variables. A one-way repeated measure design was used as a statistical technique to compare the repeated effect of the SMR intervention on L-MTrPs.

RESULTS

The result in Table 1 revealed the mean and Sd of PPT of control and SMR group. From this table it was observed that there were slightly changes in mean value of PPT in control group whereas in SMR group shows major changes in PPT from zero weeks to the sixth week.

Table 1. Descriptive statistics of control and SMR Groups.

		Control Group	**SMR Group**
Duration	N	M ± Sd	M± Sd
0th Week	15	21.33 ±1.48	20.83 ±1.75
2nd Week	15	21.83 ±1.66	21.05 ± 1.57
4th Week	15	21.99 ±1.41	21.51 ± 1.61
6th Week	15	21.90 ±1.26	24.91 ± 0.50

Note. M = Mean, Sd = Standard Deviation, SMR = Self Myofascial Release.

Table 2 is the output of testing sphericity. From this table, it was found that Mauchly's test is insignificant because the *p*-value was .647, which is greater than .05. Since Mauchly's test was insignificant, the sphericity assumption was not violated. Therefore, no correction was required in the degrees of freedom of the treatment or the error components before testing the significance of the F value. Whereas in SMR group Mauchly's test was significant because the *p*-value was .000, which is less than .05. Since Mauchly's test was significant, the sphericity assumption was violated. This requires corrections to be made in the degrees of freedom of the treatment and the error components before testing the significance of the F value. Since the sphericity exists, therefore, the degree of freedom 1.539, 21.545 instead of 3, 42 would be used. The significance of the F value was tested by means of the p-value, and therefore, the p-value differs in a situation where the Greenhouse – Geisser correction was used (p = .000) and where sphericity was assumed (p = .000). Table 2 also demonstrates the Partial eta squared (η^2), which represents the proportion of variance in the dependent variable that was explained by the independent variable(s) while controlling for other independent variables in the model. The η^2 of control group was 0.241, which is considered a small effect size, whereas the η^2 of SMR group was 0.862, which was considered a large effect size.

Table 2. Mauchly's Test of Sphericity.

	Mauchly's Test of Sphericity		**Tests of Within-Subjects Effects**	
	df	Sig.	Corrected df	Partial Eta Squared
Control Group	5.42	0.647	5.42	0.241
SMR Group	5.42	0	1.539, 21.545	0.862

Note. Df = degree of freedom.

Table 3 shows the pairwise comparisons for different weeks. The difference between the group means of the 0th week and 2nd week, 4th week, and 6th week were insignificant because of the *p*-values were greater than .05. Whereas SMR group shows 0th week, 2nd week, and 4th week was insignificant as the *p*-value was greater than .05, whereas 0th week and 6th week were significantly different as the *p*-value was less than .05. that indicate foam rolling treatment improves the PPT after 6th week of training.

Table 3. Pairwise comparisons.

		Control Group			**SMR Group**		
(I) Time	(J) Time	Mean Difference (I-J)	S. E	Sig.a	Mean Difference (I-J)	S. E	Sig.b
0th week	2nd week	-0.5	0.18	.08	-0.21	0.11	.53
	4th week	-0.65	0.22	.06	-0.68	0.22	.05
	6th week	-0.56	0.19	.06	-4.07*	0.4	.00
2nd week	0th week	0.5	0.18	.08	0.21	0.11	.53
	4th week	-0.15	0.16	1.0	-0.46	0.15	.06
	6th week	-0.06	0.21	1.0	-3.86*	0.35	.00
4th week	0th week	0.65	0.22	.06	0.68	0.22	.05
	2nd week	0.15	0.16	1.0	0.46	0.15	.06
	6th week	0.09	0.2	1.0	-3.39*	0.34	.00
6th week	0th week	0.56	0.19	.06	4.07*	0.4	.00
	2nd week	0.06	0.21	1.0	3.86*	0.35	.00
	4th week	-0.09	0.2	1.0	3.39*	0.34	.00

*Note. Based on estimated marginal means. *. The mean difference is significant at the .05 level. b. Adjustment for multiple comparisons: Bonferroni.*

Figure 4 shows that there was no improvement in PPT in general over time due to no intervention because the *p*-value between the 0th week and to 6th week is greater than .05, which indicates there was no significant increase in PPT. Thus, based on the sampled data and marginal plot, it may be concluded that there was no significant improvement in the PPT.

DISCUSSION

The present study investigates the effect of six-weeks of SMR training on L-MTrPs recovery on selected muscles. The SMR technique demonstrated a significant improvement in muscular PPT in the experimental group following repeated SMR interventions, whereas the control group showed no improvement. This study indicates that a six-week regimen of SMR, performed twice weekly for 90 seconds per session, significantly enhances the PPT in selected muscles. The underlying mechanisms of the effects of the rolling intervention are not fully understood and are still discussed(Behm & Wilke, 2019). Possible mechanisms may be subject to mechanical and physiological, neurological and psychological influences (Skinner et al., 2020). In regard to the mechanical and physiological influence, it is assumed that rolling treatment can change the properties of the tissue, such as adhesions and hardening, as well as the water content and blood circulation (Hendricks et al., 2020; Martínez-Aranda et al., 2024; Wilke et al., 2020). For example, it has been shown that after a rolling treatment on the thigh, the blood flow increased locally by around 70 % and that the supply to the muscle fibres could be improved (Hotfiel et al., 2017). However, whether the forces on the muscle myofascial release techniques are actually sufficient to dissolve myofascial adhesions and hardening is critically discussed (Behm & Wilke, 2019; Chaudhry et al., 2008). It appears that the surface of the foam roller is too wide to generate the necessary pressure to effectively alter fascia (Behm & Wilke, 2019).

A three-dimensional mathematical model was used to determine how great the mechanical forces of manual therapy would have to be to deform fascia. According to the results of the calculations, dense tissue, such as the plantar fascia and fascia lata, can only be deformed by forces that lie outside the physiological limits of humans (Chaudhry et al., 2008). Although the pressure from the foam roller does not appear to be sufficient to change the properties of the tissue, it could possibly have an effect on the mechanoreceptors located in the skin. These mechanoreceptors may include the Ruffini corpuscles, which are stimulated when stretch and shear forces occur and could inhibit the activation of the sympathetic nervous system. Perhaps this could lead to a global relaxation of the musculature and result in a change in the PPTs (Behm & Wilke, 2019). On a neurological level, it is assumed that the analgesic effect of rolling treatment is triggered by descending pain modulation. One phenomenon of endogenous pain inhibition that could possibly explain the acute hypoalgesic effect of a rolling treatment is conditioned pain modulation (CPM) (Skinner et al., 2020). CPM is based on the principle that a painful stimulus, such as rolling on a foam roller, could inhibit the pain sensitivity of subsequent stimuli via central nervous system processes (Nuwailati et al., 2022). Other myofascial treatments have been investigated with regard to an analgesic effect and CPM: For example, painful massages showed higher PPTs compared to painless massages and were associated with an improved response to CPM (Wilson et al., 2021). For myofascial trigger point treatments, it was found that there was a correlation between the analgesic effect and CPM (Szikszay et al., 2024).

The determination of remote PPT measurements is suitable for the assessment of systematic (central) mechanisms (Naugle et al., 2012). In this study, various authors (Cheatham et al., 2017; Cheatham & Baker, 2017; Cheatham & Kolber, 2018; Young et al., 2018) showed that rolling treatment resulted in a change in remote PPTs on the non-treated side in a pre-post comparison. Based on these results, it could be argued whether the PPTs were possibly altered by the influence of the central nervous system, for example by CPM. However, the meta-analysis presented could not confirm this hypothesis, as no comparison could be made between the rolling interventions and control groups for remote PPTs (Behm & Wilke, 2019). However, the explicit psychological effects of rolling interventions have not yet been investigated. Other myofascial treatments, such as massages, appear to have an effect on the psyche and correlate with reduced stress and increased well-being (Dakić et al., 2023). Furthermore, studies have shown that the hypoalgesic effect of painful massages was significantly greater when people had a positive expectation during the massage.

In contrast, no hypoalgesic effects were found in people with negative expectations. Interestingly, the expectation towards massages had no influence on pain sensitivity when people received pain-free massages (Wilson et al., 2023).

Therefore, foam roller to treat L-MTrPs offers an intriguing approach to addressing muscle function impairments caused by these points. A major advantage of self-myofascial release (SMR) is that athletes can perform treatments themselves, tailoring them to their individual needs. Although the effects need further validation through larger trials, especially against a placebo control, the relatively short duration of treatment makes it feasible to use during game breaks, such as halftime, and warm-ups. Future research should focus on understanding dose-response relationships, such as the effectiveness of longer or repeated treatments compared to a single session and examine the efficacy of this intervention on other body regions and active myofascial trigger points.

CONCLUSIONS

Using a foam roller to apply dynamic compression to L-MTrPs can help athletes improve muscle function and optimize performance. Our findings suggest that self-myofascial release could play a significant role in treating sports-related pain syndromes. Therefore, further research is necessary to fully understand the potential benefits and mechanisms of self-myofascial release in managing these pain conditions. This research should explore the specific techniques, duration, and frequency of foam rolling required to achieve the best outcomes for pain relief and muscle recovery in athletes. Understanding these factors could lead to more effective and targeted therapies for enhancing athletic performance and reducing injury-related impairments.

AUTHOR CONTRIBUTIONS

All authors have contributed meaningfully to all phases of the project. Dr. Rajdeep Das: Contributed to the study design, development of the intervention protocol, data collection, and drafting of the manuscript. Dr. Anshuman Shukla: Involved in study design, statistical analysis, interpretation of results, and manuscript revision. Dr. Birendra Jhajharia Participated in subject coordination, implementation of the intervention, and data processing. Dr. Cătălin Vasile Ciocan: Supervised the entire research process, contributed to theoretical framework development, final editing and correspondence with the Journal.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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