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ORIGINAL ARTICLE

The Acute Effect of the Application of the Myofascial Release to the Balance, Anaerobic Power and Functional Movements in Young Soccer Players

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Abstract

20 male soccer players who play in the Amateur League in Denizli participated voluntarily in this study. Demographic data of the participants were questioned and recorded before the application of Foam Roller (FR). Y-balance test (YDT), Single-step and 3 step jump test, Functional movement screen (FMS) tests were applied to the participants. After 48 hours of rest, the same tests were repeated after FR applied to hamstring, quadriceps, gluteal, latissimus dorsi and gastro group muscles. FR was applied by bilateral to each region as 2 sets with 60 seconds of application, 30 seconds of rest. The statistically significant difference was found in FMST total score, stride (right-left), active straight leg lift (right-left), all aspects of left-sided (right-left), left YDT composite score (right-left) of the functional motion scores before and after FR applications. No significant difference was found in other parameters of FMST and jump test results. As a result, the myofascial release application with single session didn't change the jump performances in participants. But It has been determined that the functional movement and dynamic balance performances of the athletes were increased.

Introduction:

The myofascial release [self-myofascial release (SMR)] technique is becoming increasingly popular. Myofascial relaxation is described as an application of pressure that relaxes the fascia and allows the adhesion of the tissues, the relaxation of the shortened and stretched muscles, the removal of lactic acid and other fatigue substances from the muscles, and the recovery of the blood flow on the damaged tissue (Zorko *et al.,* 2016; Rey *et al.,* 2017; Jön *et al.,* 2018; Hendricks *et al.,* 2020). In the application of this technique, foam rollers (FR) are mostly used. In this method, people put their own body on the FR and move back and forth, applying pressure to the fascia wrapped on the muscle, and the fascia is relaxed. It is known that myofascial relaxation has effects such as regulation of muscle imbalance, reduction of muscle pain and joint stiffness and increase of neuromuscular tone, increasing flexibility and neuromuscular activity in the musculotendinous compound, and ensuring normal functional muscle length (Killen *et al.,* 2018; Richman *et al.,* 2019; Guillot *et al.,* 2019). Therefore, the myofascial relaxation method is also generally used as a method of recovery and physiotherapy after exercise (Anderson *et al.,* 2011; Okamoto *et al.,* 2014; Schroeder & Best, 2015; Rey *et al.,* 2017; Hendricks *et al.,* 2020). However, it has recently been seen as a pre-exercise warm-up activity in sports sciences (Behm & Chaouachi, 2011). Studies claim that pre-exercise self-applied FR application can increase balance, flexibility, and range of motion through myofascial release, which may lead to increased mobility and increased neuromuscular activity (Castiglione, 2010; Hall & Smith, 2018). It has also been stated in some studies that FR applications in athletes are accepted as a pre-exercise technique applied to increase range of motion, flexibility, and jumping performance (MacDonald *et al.,* 2013; Okamoto *et al.,* 2014; Richman *et al.,* 2019). As with massage practice, it is suggested that FR application before an exercise helps to correct muscle-length-tension relationships and allows for better warming (Depino *et al.,* 2000; Zorko *et al.,* 2016; Hall & Smith, 2018). However, in recent years, research results are showing that muscular performance (sprint, jump, agility, etc.) has been adversely affected by changes in neurogenic (autogenic

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inhibition) and mechanical factors (reduction in optimal stiffness of the muscle-tendon unit) as a result of FR application (Jo *et al.,* 2018). For this reason, FR application can be used as a sportive warm-up or performance-enhancing tool as a new method that can be applied with FR instruments (TFR), massage balls, various handheld tools (handheld muscle stick roller, thera cane, quadballer roler, etc.). There are conflicting research results (Beardsley & Skarabot, 2015; MacDonald *et al.,* 2014). Although many studies are investigating the effect of FR application before exercise on athletic performance in the literature, limited studies are investigating the acute effect of FR application on balance and anaerobic power. In one of these studies, MacDonald *et al.,* (2013) measured the effect of FR application on vertical jump performance after 0, 24, 48, and 72 hours and reported that vertical jump did not increase acutely after FR application, however, vertical jump results were higher after 24 and 48 hours (MacDonald *et al.,* 2013). Contrary to this study, Peacock *et al.,* (2014), in addition to dynamic stretching, higher performance in the vertical jump, standing long jump, agility, and power values of the athletes compared to dynamic stretching alone (Peacock *et al.,* 2014). Besides, Cho *et al.,* (2016), it was reported that FR application increased the proprioception of athletes (Cho *et al.,* 2016). However, when the relevant literature is examined, no study has been found that investigates the balance, anaerobic power, and functional movement performance of the athletes of the FR application. This study aims to improve the balance, anaerobic power, and functional movement of self-applied FR application, which has recently started to be used widely in sports sciences, especially in team sports, which is claimed to increase the neuromuscular function of the athlete and has little evidence about the effects on dynamic force generation abilities to investigate the acute effect on performance.

Materials and Methods:

A total of twenty male soccer players who play in the Amateur League in Denizli (20 ± 4.15 years old, 177.45 ± 7.03 height, 70.06 ± 6.18 kg). participated voluntarily in this study. The subject group was selected from the athletes who went through the same training process in the last 6 months and did not have a history of injury in the last 1 year. A familiarization study was performed on the day before the tests. Before the FR application, the demographic data of the participants were questioned and recorded. The subjects were informed about the possible risks and benefits of the study and gave their informed consent to participate in this study, which was approved by the Clinical Research Ethical Committee of Pamukkale University (60116787-020/28705).

Before the study, the height and weight measurements of the athletes were measured with a stadiometer (Seca, Germany), and then the following tests were applied.

Functional Movement Screen (FMS) is a system based on scoring seven movement patterns that form the basis of human movement according to certain criteria. It is aimed to score functional movement patterns, mobility, and stability with the tests in the evaluation system. The evaluation of these three main pillars gives information about the complex nature of motor control. It is used to evaluate 3 test functional movements, 2 test flexibility, and 2 test stability within the system. Each movement pattern is scored between 0 and 3, and the scores of seven movement patterns are added together to give a total score. Besides, the scores of each sub-unit can be evaluated by adding them within itself. High scores indicate good action (Cook *et al.,* 2006).

The dynamic balance of the athletes was evaluated with YBT. The amount of reaching out on the dominant extremities of the athletes was measured. The athletes were asked to stand on one foot in the midpoint of the test setup and touch with the tip of the toe while maintaining the balance with the other foot in the anterior, posteromedial and posterolateral directions (Plisky *et al.,* 2009). The test was repeated 3 times in all directions, averaged, and recorded in cm. The lower extremity lengths (sias-medial malleolus) of the athletes were calculated bilaterally in cm and the composite score was determined. \

The anaerobic power values of the athletes were determined by single step and triple jump tests, and the test was repeated twice separately for both extremities and the best value was recorded in cm (Grindem *et al.,* 2012).

The pre-test and post-tests of the athletes were applied at the same time of the day and with an interval of 48 hours. FR application was performed rhythmically by the athlete himself, starting from the midpoint of the muscle towards the origo, to the hamstring, quadriceps, gluteal, latissimus dorsi, and gastro group muscles. This application was applied bilaterally to each region (2 sets, 60 seconds of application, 30 seconds of rest) (Sagiroglu *et al.,* 2016). After the FR application, all tests were performed again and the results were recorded.

Descriptive statistical values (mean±standard deviation) were calculated for the balance, jump, and functional movement values of the athletes before and after FR application. The suitability of the variables to normal distribution was tested by Shapiro-Wilk analysis and it was determined that the parametric conditions were met. T-test analysis was used in Dependent Groups for the comparison of balance, jump, functional motion parameters in pretest-posttest. The level of significance was accepted as 0.05 for all analyzes.

Results:

Within the scope of the study, 20 male soccer players were evaluated. Descriptive characteristics of athletes were as Height (cm) 177.45+7.03 Body weight (kg) 70.6 ± 6.18 ;

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Table-1: Comparison of Pre-test and Post-test YBT Test Parameters (in centimeter) of the Subject (Mean±SD)

Type of test	Anterior R	Anterior L	Posteromedial R	Posteromedial L	Posterolateral R	Posterolateral L	Composite Score R	Composite Score L
Pre-test	63.9+7.2	63.85+5.22	98.45+6.08	103.05+4.93	98.1+6.41	96.35+5.26	98.21+7.95	94.51+10.02
Post-test	66.8+7.18	66.8+5.54	102.1+6.27	105.55.27	102.15+6.01	99.45+5.12	96.99+8.94	97.69+7.03
t	-3.51	-3.17	-4.12	-4.34	-4.18	-5.99	-3.34	-2.37
p	0	0.01	0	0	0	0	0.02	0.03

Age(Years)20±4.15; Training age(years) 6.75±2.30. The comparison of the balance parameters of the athletes before and after FR application is given in Table-1. According to Table 2, a significant difference was found between all three directions and both extremities of the YCT balance test before and after the FR application of the athletes ($p < 0.05$) and this difference was found to be in favour after FR application. Table-2 shows the functional movement values difference analysis table of the athletes before and after FR application. According to Table 3, a statistically significant difference and the increase were found between the FMS total score and inline lunges from the functional movement scores of the athletes before and after FR application ($p < 0.05$).

Table-2: Comparison of Pre-Test and Post-Test FMS T Parameters of the Subject

	Test Period	Mean±Sd	t	p
FMS Total Score	Pre-T	13.95±1.82	-7.55	0.00
	Post-T	16.20±1.19		
Deep Squat	Pre-T	1.65±0.67	-1.32	0.2
	Post-T	2.05±1.36		
Hurdle Step with Left leg	Pre-T	1.80±0.41	-1.83	0.08
	Post-T	1.95	0.39	
Hurdle Step with Right Leg	Pre-T	1.95±0.69	-1	0.33
	Post-T	2.05±0.51		
Inline Lunge with left leg	Pre-T	1.90±0.64	-3.56	0.00
	Post-T	2.30	0.47	
Inline Lunge with right leg	Pre-T	2.00±0.65	-2.35	0.03
	Post-T	2.30±0.47		
Shoulder Mobility (left)	Pre-T	2.75±0.44	-1.46	0.16
	Post-T	2.85±0.37		
Shoulder Mobility (right)	Pre-T	2.95±0.22	1	0.33
	Post-T	2.90±0.31		

* The t value could not be calculated since the difference between standard deviations is zero

Table-4: Comparison of Pre-test and Post-test Jump Parameters of the Subject

	Test Period	Mean±Sd	t	p
One leg hop test with right leg (cm)	Pre-T	146.15±10.99	-2.08	0.60
	Post-T	151.00±7.81		
One leg hop test with left leg (cm)	Pre-T	146.50±10.20	-1.06	0.30
	Post-T	149.50±9.48		
Three hop test with right leg (cm)	Pre-T	499.30±30.45	-6.02	0.67
	Post-T	502.25±33.55		
Three hop test with left leg (cm)	Pre-T	484.85±27.12	-4.05	0.75
	Post-T	497.95±34.01		

As per Table-3, in which jump performances of athletes before and after FR application were compared, no significant difference or increase was found between the jump test results of the athletes before and after FR application ($p > 0.05$).

Discussion:

In this study, in which the acute effect of single-session FR application on balance, anaerobic power, and functional movement performance in young soccer players was investigated, the total FMS score of the athletes before and after FR application, stepping in a single line in both extremities, active straight leg raising scores, In the directions and while the YBT increased the composite score (right-left), there was no increase in the jump performance and other parameters of the FMS.

Scientifically, many positive effects of FR are assumed, but most of these effects have not been proven. Most of the studies on self-myofascial techniques in the literature are directed towards acute effects (Aboodarda *et al.,* 2015; Cavanaugh *et al.,* 2017; Halperin *et al.,* 2014; Healey *et al.,* 2014; MacDonald *et al.,* 2013; Skarabot *et al.,* 2015).

Peacock *et al.,* (2014), in their study on male athletes, it was reported that power, strength, agility, and speed performance of athletes after whole-body dynamic warming and whole body FR application were more effective than applied dynamic exercises, but they had no effect on flexibility values. The researchers explained the reason for the lack of effect of FR application on flexibility with the physiological developments of the movement and fiber pattern associated with myofascial release. Su *et al.,* (2017) examined the acute effects of static and dynamic stretching with FR on muscle flexibility and muscle strength. According to the study findings, the flexibility test scores of the participants were reported to be higher after the foam roller application compared to static and dynamic stretching. Also, they reported that the muscle strength of the participants improved significantly after the dynamic stretching and foam roller application. As a result, they stated that the foam roller application provides an acute development of flexibility in the quadriceps and hamstring muscles and is more effective than static and dynamic stretching and can be used as a part of warming up in training. In our study, we think that the significant increase observed bilaterally in the active straight leg lift test, which is the flexibility component of FMS, can be explained by the positive effects of FR on the fascia and the resulting increase in flexibility. Also, according to Guyton (2001), myofascial pressure increases oxygen release with pressure, allowing 256 times more blood flow through the

vessels and causes vasodilation. We think that the significant increase in the FMS total score of the participants in our study may be the result of both the significant increase in active straight leg raising pattern and the increased functional range of motion with vasodilation.

Studies on FR and YBT in the literature are inconsistent. Some studies state that the FR application applied before exercise has positive effects on sports performance (Castiglione, 2010; Halperin *et al.,* 2014; Junker & Stöggl, 2019). Some studies state that FR does not show any effect on balance flexibility and range of motion. (Healey *et al.,* 2014; MacDonald *et al.,* 2013).

Castiglione (2010) claims that pre-exercise self-administered FR application can provide an increase in balance, flexibility, and range of motion of the participants through myofascial release, which may lead to increased mobility and increased neuromuscular activity. Also, there are findings in some similar studies that FR application improves the dynamic balance of the participants (Filipa *et al.,* 2012; Granacher *et al.,* 2014; Imai *et al.,* 2014; Junker & Stöggl, 2019). Besides, Halperin *et al.,* (2014) reported that self-made myofascial release does not have an acute effect on static and dynamic balance. The reason for the statistically significant increase in all aspects of the YBT and the YBT composite score (right-left) in our study can be explained as a result of the increased neuromuscular control mechanism.

The acute effect of FR application of our study on explosive force performance is similar to the literature. Romero *et al.,* (2019), it was determined that FR application was an acute positive increase in the jumping performance of athletes, but this increase was not statistically significant. In another similar study by Jones *et al.,* (2015), it was found that FR exercises applied in addition to dynamic warming and dynamic warm-up did not show a significant difference or increase in the vertical jump performance of the participants. In our study, it was found that the FR application does not affect power. However, contrary to these results, Sagiroglu (2017) reported in his study on male soccer players that FR application applied to the lower extremity showed an improvement in both vertical jump and flexibility performances of the participants. The reason for these different results in the literature may be due to the difference in the FR applied muscles and the application time. As it is known, FR type, application time, and rhythm are very important variables in FR applications.

It was determined that there is only one study in the literature evaluating FR and FMS performance together. In the study conducted by Boguszewski *et al.,* (2017), it was determined that 37 healthy and physically active women minimized the functional limitations of the musculoskeletal system of the participants in the FMS test after FR application. It has also been reported that FMS has significant improvements in the hurdle step and active straight leg raise test performances. It was stated that these developments occurred as a result of the positive effect of FR application on the functionality and joint mobility of the massaged muscles (Boguszewski *et al.,* (2017).

This study has a limitation. Verbal statements were made to the participants that they should not do any other flexibility training, massage, or manual therapy, other than unit training, during the 48 hours between the pre-test and the post-test. However, this process could not be controlled.

Conclusion:

It was seen that FR application did not cause a change in the anaerobic power performance of the athletes, but it provided an increase in the balance and functional movement scores of the athletes. Balance and anaerobic strength development of athletes are very important for their optimal performance. This application can be included in the warm-up periods of the athletes because it is cheap and easy to apply. Besides, we believe that it may lead to an increase in performance and a decrease in injury risk due to the improvement in balance and functional movement patterns. Because of the high balance and FMS scores are reported in the literature as an indicator of the low risk of injury in athletes. In future studies, the effects of different FR type preferences, application time, and rhythm variables on flexibility, muscle strength, and power output can be investigated by considering the effect of FR application during the recovery process and the pressure variable that occurs due to the load transfer on FR by the participants.

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