ORIGINAL ARTICLE

The effect of 6 weeks functional myofascial line exercises on sprint and agility in 12-14 aged tennis athletes

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ABSTRACT

The aim of this study was to examine the effect of functional myofascial line exercises applied for 6 weeks on sprint and agility in 12-14 years old tennis players. The sample consisted of 13 girls and 13 boys aged 12-14 years who were tennis athletes in Antalya. In addition to tennis training in the experimental group an exercise programme consisting of four exercises for 6 weeks, 2 days in a week was conducted. The control group continued only tennis training. As a result of the research, the girls experimental group's 20 m sprint pre-test and post-test statistically significant difference (p = .02) with a large effect size (r = .63); v-cut agility pre-test and post-test with a large effect size (r = .57) a statistically significant difference (p = .04) was found. In addition, a statistically significant difference (p = .01) was found between the 20 m. sprint pre-test and post-test of the boys experimental group with a large effect size (r = .63); a statistically significant difference (p = .01) was found between the v-cut agility pre-test and post-test with a large effect size (r = .63). In the control group, 20 m. sprint in both boys and girls groups there was no statistically significant difference between pre-test and post-test and v-cut agility pre-test and post-test.
Keywords: Performance analysis, Myofascia, Fascial line, Tennis, Speed, Agility.

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INTRODUCTION

Tennis is a game of short, high-intensity repetitive movements, with medium and high intensity (Torres-Luque et al., 2011). Tennis players cover an average distance of 8-15 m for a point, change 4 directions and they hit the ball 4-5 times on average for each point played (Murias et al., 2007). Tennis players have a very good reaction time and are able to have explosive first step speed to react quickly to the ball (Kovacs, 2006). For tennis athletes to be successful, aerobic performance, speed, agility and power must be efficient (Fernandez, 2009). Therefore, strength, power, speed and agility as a prerequisite for success in tennis together (Fernandez-Fernandez, 2018). At the same time to the opponent non-contact tennis; fast change of direction, fast arm movements, jumping and strength is needed (Özcan, 2011). With studies conducted in the early period, enhanced speed and change of direction ability can help children improve their performance in tennis matches (Wang et al., 2022).

Kinetic chain is defined as "*a number of successively arranged motor units forming a complex motor unit joint*" (Karandikar & Vargas, 2011). Although it appears that the ball is sent to the opposite side with the movement of the upper limb in tennis athletes, in relation to upper limb skill performance, the work in the upper limb segments is transmitted to the trunk and spine through a large musculoskeletal surface. There is an exchange of forces across this musculoskeletal surface resulting in a large amount of energy production (Ellenbecker & Aoki, 2020). There are structures in the human body that are not independent of each other and interact with each other. One of them is that the kinetic chain is an interconnected system with fascial lines as a whole and any movement instantly affect each other (Dischiavi et al., 2018). Sports of complex motor skills such as tennis require effective kinetic chain coordination (Colomar et al., 2020). Disruption of a single element in the kinetic chain causes modification of the entire chain, leading to sub-optimal biomechanical adaptations may lead to a decrease in the efficiency of the movement (Kilit, 2017).

Fascia refers to all fibrous connective tissue under tension that both encloses and surrounds muscles, bones, organs, nerves, blood vessels and other structures and extends from head to toe in a continuous, three-dimensional network (Findley, 2009). Fascia is a tissue that contains properties that can respond to mechanical stimuli (Bordoni & Myers, 2020) and consists of fibrous collagenous tissues that are part of the conduction system, a tension force in the whole body (Beardsley & Škarabot, 2015).

Nowadays, fascia has become a very important subject for clinicians, physiotherapists and sports scientists with the development of measurement tools and studies. Fascia are seen as elements of a tensile force transmission network throughout the body and are defined as all collagen fibrous connective tissues in the body (Schleip & Baker, 2015). When muscles contract, they not only move the bones, but also stretch the deep fascia through fascial expansions (Stecco et al., 2009).

Fascia and tendons work together and therefore the movement of one muscle can lead to the movement of other muscles in which this muscle is involved. In this association during movement, the transfer of force from the muscle to the skeletal system is mostly related to the intermuscular myofascia. Muscles transmit 40% of their contractile force not to their own tendons but to other muscles in close neighbourhood via fascial connections. This involves the transfer of force to the antagonist muscles and leads to increased resistance to the movement (Özsu & Kurt, 2018; Kumka & Bonar, 2012).

Fascia appears to be integrally involved in the biomechanics of the musculoskeletal system (Gerlach & Lierse, 1990). There are 12 lines in myofascia and in one line it is thought to have an effect on the intermuscular coordination of the muscles with each other. Among these lines, functional myofascial anterior and posterior lines are important for tennis athletes. Functional myofascial anterior and posterior lines when extending it to the limb on the opposite side of the body, connecting it to the limb on the opposite side of the body, it extends the lever arm and gives us extra strength and sensitivity. An example of this is in tennis, where the movement of the pelvis contributes to the backhand stroke. These lines maintain a constant balance between the shoulder and hip contralaterally during walking (Myers, 2009).

The Functional Posterior Line (Figure 1); starts with the distal adhesion of the latissimus dorsi, joins the superficial lamina of the sacrolumbar fascia, descends towards the sacral fascia and connects with the lower fibres of the gluteus maximus. The lower fibres of the gluteus maximus pass under the posterior edge of the illiotibial tract and thus attach to the posterolateral edge of the femur below the lateral line, approximately 1/3 below the femoral shaft. Continuing in the same direction, fascial fibres are found connecting to the gluteus and vastus lateralis muscles. These fascial fibres continue downwards and connect with the quadriceps tendon, subpatellar tendon and tibial tubercle (Myers, 2009).

The Functional Anterior Line (Figure 2); the distal attachment site crosses the lower lifts of the humerus and attaches to the 5th and 6th costa, the origin of the pectoralis major. Since the claviculapectoral fascia contains the pectoralis minor, it also attaches to the 5th costa. These pectoral fibres connecting to the abdominal aponeurosis and the external oblique and rectus abdominis muscles forms a fascial continuum and runs along the more outer edge of the rectus or along the more inner edge of the oblique fascia towards the pubis as a strip of fascia, also known as the semilunar line. Passing through the pubic region and symphysis pubis, it passes to the other side with the durable tendon of adductor longus. Moving downwards, upwards, outwards and backwards attach to the linear aspera of the femur (Myers, 2009).

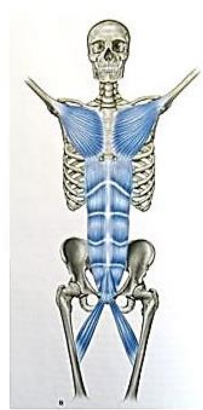

Figure 1. Functional back line. Figure 2. Functional front line.

The concept of the myofascial line, i.e. that tension in a contracted area has repercussions and affects other areas near and far, is used in different disciplines from physiotherapy to yoga, sports to meditation (Bordoni & Myers, 2020). Ingber stated that due to the holistic and interconnected structure of the fascia in the body, an increase in tension in one region will cause an increase in tension in the whole structure, not only in the part where the structure is located, but also in the opposite part (Ingber, 1993).

Stress transmission along the myofascial line can contribute to the proper functioning of the movement system (Grieve et al., 2015). Ensuring that the tension on one myofascial line is evenly toned can affect the entire fascia chain. The reason for this may be the comfortable movement of interconnected tissues and the correct distribution of forces (Lindsay & Robertson, 2008).

Studies show that the tension produced by a given muscle is not transmitted entirely to its tendons but can also be transmitted to connective tissues in and around the muscle (endomysium, perimysium, epimysium) and to extra-muscular connective tissues (fascia, neurovascular system) (Huijing, 2009; Purslow, 2010; Smeulders & Kreulen, 2007; Yücesoy, 2010). Ruffini and Pacini bodies, which are mechanoreceptors commonly found in myofascia contains muscle receptors located between the tissue. Pressure applied to mechanoreceptors can stimulate the nervous system and thus cause a reduction in muscle tension (Beardsley & Škarabot, 2015). In an exercise, it can cause a force transfer from the working muscle to the surrounding fascia (Findley et al., 2015).

The force generated by the muscle can be transferred directly between the synergist muscles via the epimysium or indirectly affect the antagonist via the neurovascular tract (Huijing et al., 2011). Muscle contraction directly stretches the overlying fascia and thus changes the stiffness of the connective tissue (Findley et al., 2015).

In addition to bilateral exercises, if exercises are performed to increase muscle strength on one side of the body (unilateral), voluntary strength may increase on the opposite side. Following a unilateral strength training programme, strength increases are observed in the contralateral untrained limb (Carroll et al., 2006).

From a mechanical point of view, the close relationship between fascia and trunk muscles clearly implies that the role of fascia in movements cannot be separated from the movements of muscles, and each time the muscle contracts, selective spatial stretching of the associated fascia must also occur (Stecco et al., 2011).

Speed is physiologically identified with concepts such as perception, reaction, movement and acceleration (Günay, 2008). Speed, power output and forward acceleration are key physical determinants of performance in many activities in sport (Cronin & Sleivert, 2005). Athletes need more speed to react to a sudden movement from a stationary position (Sasa, 2019). The long duration of tennis competitions requires the need for oxidative energy system and phosphagen (ATP-CP) system is used during the ball shots (Ben Kibler & Sciascia, 2004). Good intramuscular and intermuscular coordination skills contribute to the development of speed and speed is greatly improved by the harmonious functioning of muscles and nerves (Karaca, 2016). The 20m sprint, change of direction tests, jumping ability tests and field-based tests are commonly used in tennis players (Cooke et al., 2011).

Various definitions have been made about agility. Agility is the ability to change the direction and/or speed of movement quickly and efficiently (Sekulic et al., 2017), the ability to change body position quickly and accurately, to stop, move, change direction and speed in a controlled manner (Miller, 2006), rapid change of speed and direction of movement in response to an external stimulus and whole body movement (Krolo et al., 2020; Sheppard & Young, 2006).

For the best realisation of agility performance, the neuromuscular system must function efficiently. It is known that the neuromuscular system has the ability to efficiently store, reappear, combine, use and change when more than one motor unit is needed to produce the desired movements (Aaberg, 2007).

In agility, one responds to a pre-planned and known response, but in tennis, one must respond to unpredictable (mostly visual) stimuli, so unplanned agility, change of direction speed (CODS) and reactive agility terms are used in tennis (Sekulic et al, 2017). Tennis is a sport where both agility performances (i.e. CODS and reactive-agility) are important in certain situations (Cooke et al., 2011).

We hypothesise that exercise programmes designed in connection with one of the muscles in the myofascial lines can give effective results. We think that the compatibility of myofascial anterior and posterior lines with the movement mechanics of tennis athletes will provide efficient results for the speed and agility of athletes. With these assumptions, the aim of this study was to investigate the effect of functional myofascial line exercises on speed and agility in tennis athletes.

METHOD

Participants

The study included volunteer boys and girls between the ages of 12-14 years, residing in the province of Antalya in Turkey and playing tennis. For this purpose, groups were formed from the athletes who applied to the sports club. For the study, two groups of 13 athletes each were randomly selected as Experimental Group (EG) and Control Group (CG). In addition to tennis training, the EG was trained with functional fascial line exercises for 30 minutes a day, 2 days a week for 6 weeks. The CG continued tennis training only. The exercise programme was selected according to the developmental level and age of the children.

Parents or legal guardians received detailed information about the research process and provided written informed consent. The research was conducted in the latter half of 2022 and received ethical approval from the University of Alanya Alaaddin Keykubat Committee for Research Ethics (Approval No. 3(9)/2022), adhering to the Declaration of Helsinki.

Measures and procedures

In the measurement part of the research, the COD Timer application V-Cut test was used for agility. The COD timer application was found to be in almost perfect agreement with the start and end gates to measure the total time in a change of direction test. Studies have shown that the COD Timer App and My Sprint App are valid and reliable (Silva et al, 2021).

Figure 3. Myofascial line exercises.

For one side, 4 exercises (Figure 3) consisting of 10 repetitions (right and left 20) with 50-70% intensity and fast tempo were performed in 3 sets. 1 minute rest was given between each set. Rest was given for 2 minutes between exercise changes.

The data captured on video with I-phone 7 plus model phone (high-speed video recording, 240 fps) were analysed with COD Timer application (V-Cut Agility Test) and My Sprint application (20-metre Sprint Test) and data entries were made.

To determine the 20 m sprint time, 2 funnels were placed 20 m apart. The athlete was instructed to run from the starting point to the end point in the fastest way. Meanwhile, the athlete's run was videorecorded horizontally at the 10 m line with an iPhone 7 plus model phone and uploaded to My Sprint application. In the application, the time from the starting point to the end point was analysed and recorded.

In the V-Cut test, athletes performed a 25 m sprint with 2 funnels of 5 m each at 45°. For the trial to be valid, the athletes had to cross the line with one foot completely on the ground at each turn. If the attempt was considered unsuccessful, a new attempt was allowed. The distance between each pair of cones was 0.7 m. The fastest trial time was recorded (Gonzalo-Skok et al., 2015).

Statistical analysis

SPSS 25 package programme was used to analyse the data obtained in the study. Frequency and percentage values were used among statistical techniques. Non-parametric tests were preferred due to the limited number of research sample. Wilcoxon signed-rank test was used among non-parametric tests. Significance level was taken as $p < .05$.

RESULTS

The findings obtained from the data of the research are given below in order.

Table 1. Descriptive statistics for experimental and control group.

Group	Gender	Variable	N	Min.	Max.	Mean	Sd
*Exp.	Girls	Age	6	12.00	14.00	12.50	0.83
		Weight	6	36.00	61.00	47.33	10.05
		Height	6	152.00	161.00	156.66	3.66
		N	6				
	Boys	Age	7	12.00	14.00	12.85	1.06
		Weight	7	34.00	76.00	53.71	16.15
		Height	7	143.00	183.00	162.85	16.26
		N	7				
Control	Girls	Age	6	12.00	14.00	12.83	0.75
		Weight	6	37.00	60.00	48.83	9.49
		Height	6	160.00	169.00	164.16	3.43
		N	6				
	Boys	Age	7	12.00	14.00	13.00	0.816
		Weight	7	37.00	57.00	48.00	7.70
		Height	7	147.00	170.00	160.85	7.88
		N	7				

*Note. *Exp = Experimental.*

Table 1 shows the age, body weight and height data of the research group. The average age of the girls experimental group was 12.50 ± 0.83 and the average age of the boys experimental group was 12.85 ± 1.06;

the average age of the girls control group was 12.83 ± 0.75 and the average age of the boys control group was 13.00 ± 0.81. The average body weight of the girls experimental group was 47.33 ± 10.05 and the average body weight of the boys experimental group was 53.71 ± 16.15; the average body weight of the girls control group was 48.83 ± 9.49 and the average body weight of the boys control group was 48.00 ± 7.70. The average height of the girls experimental group was 156.66 ± 3.66 and the average height of the boys experimental group was 162.85 ± 16.26; the average height of the girls control group was 164.16 ± 3.43 and the average height of the boys control group was 160.85 ± 7.88.

Table 2. Skewness and Kurtosis statistics of the data.

Group	Gender	Tests	N	Min.	Max.	Avg.	Sd.	Skewness	Se	Kurtosis	Se
*Exp.	Girls	20 m. Sprint Pre	6	329.00	383.00	359.16	18.57	-0.64	0.84	0.65	1.74
		20 m. Sprint Post	6	311.00	380.00	335.33	27.29	0.99	0.84	-0.24	1.74
		V-Cut Agility Pre	6	803.00	867.00	831.16	27.70	0.40	0.84	-2.24	1.74
		V-Cut Agility Post	6	760.00	834.00	800.33	25.95	-0.47	0.84	0.07	1.74
		N	6								
	Boys	20 m. Sprint Pre	7	303.00	362.00	332.14	22.94	-0.02	0.79	-1.49	1.58
		20 m. Sprint Post	7	292.00	333.00	311.00	14.53	0.12	0.79	-0.91	1.58
		V-Cut Agility Pre	7	713.00	887.00	787.28	56.29	0.67	0.79	0.80	1.58
		V-Cut Agility Post	7	690.00	817.00	746.14	47.47	0.55	0.79	-1.02	1.58
		N	7								
Control	Girls	20 m. Sprint Pre	6	366.00	386.00	371.00	7.84	1.86	0.84	3.44	1.74
		20 m. Sprint Post	6	355.00	410.00	377.16	20.25	0.77	0.84	0.06	1.74
		V-Cut Agility Pre	6	820.00	860.00	834.50	16.65	0.88	0.84	-1.04	1.74
		V-Cut Agility Post	6	820.00	880.00	841.16	23.49	1.15	0.84	-0.11	1.74
		N	6								
	Boys	20 m. Sprint Pre	7	323.00	373.00	343.14	19.28	0.54	0.79	-1.02	1.58
		20 m. Sprint Post	7	320.00	389.00	350.85	25.22	0.30	0.79	-0.98	1.58
		V-Cut Agility Pre	7	767.00	843.00	819.00	30.21	-0.92	0.79	-0.55	1.58
		V-Cut Agility Post	7	760.00	900.00	833.00	48.07	-0.06	0.79	-0.60	1.58
		N	7								

*Note. *Exp: Experimental, Avg.: Average, Sd: Standard deviation, Se: Standard Error.*

Table 3. Wilcoxon Signed Rank test.

Group	Gender	tests	N	Percentiles		
				25th	50th (Median)	75th
Experimental	Girls	20 m. Sprint Pre	6	344.00	362.50	372.50
		V-Cut Agility Post	6	808.25	823.50	861.75
		20 m. Sprint Pre	6	314.00	325.50	361.25
		V-Cut Agility Post	6	777.25	804.00	821.25
	Boys	20 m. Sprint Pre	7	306.00	329.00	356.00
		V-Cut Agility Post	7	747.00	793.00	817.00
		20 m. Sprint Pre	7	296.00	311.00	320.00
		V-Cut Agility Post	7	704.00	741.00	801.00
Control	Girls	20 m. Sprint Pre	6	366.00	367.50	376.25
		V-Cut Agility Post	6	820.00	828.50	852.50
		20 m. Sprint Pre	6	358.75	374.00	395.00
		V-Cut Agility Post	6	825.25	830.00	865.00
	Boys	20 m. Sprint Pre	7	323.00	342.00	363.00
		V-Cut Agility Post	7	797.00	840.00	843.00
		20 m. Sprint Pre	7	325.00	354.00	375.00
		V-Cut Agility Post	7	802.00	840.00	880.00

Table 2 shows the kurtosis skewness values of the experimental and control group data. George & Mallery (2010) stated that when the kurtosis skewness values are between -2 and +2, the data are normally distributed. Although only a few of the data were found to be above these values, non-parametric tests were preferred due to the limited number of research sample.

Table 3 shows the median data of the experimental and control groups. The 20 m sprint median values of the girls experimental group decreased after the implementation (Md = 325.50) compared to before the implementation (Md = 362.50). V-Cut Agility median values of the girls experimental group decreased after the implementation (Md = 804.00) compared to before the implementation (Md = 823.50). The 20 m sprint median values of the boys experimental group decreased after the implementation (Md = 311.00) compared to before the implementation (Md = 329.00). V-Cut Agility median values of the boys experimental group decreased after the implementation (Md = 741.00) compared to before the implementation (Md = 793.00).

Table 4. Wilcoxon Signed Rank test.

Group	Gender		20 m. Sprint Post 20 m. Sprint Pre	V-Cut Agility Post V-Cut Agility Pre
*Exp.	Girls	Z	-2.20[a]	-1.99[a]
		p	.02*	.04*
	Boys	Z	-2.36[a]	-2.37[a]
		p	.01*	.01*
Control	Girls	Z	-1.15[b]	-1.41[b]
		p	.24	.15
	Boys	Z	-1.18[b]	-1.19[b]
		p	.23	.23

*Note. [a]. Based on positive ranks. [b]. Based on negative ranks. *p < .05.*

When Table 4 is analysed, a statistically significant difference (*p* = .02) was found between the 20 m. sprint pre-test and post-test of the girls experimental group with a large effect size (r = .63); a statistically significant difference (*p* = .04) was found between the V-Cut Agility pre-test and post-test with a large effect size (r = .57). In addition, a statistically significant difference (*p* = .01) was found between the 20 m. sprint pre-test and post-test of the boys experimental group with a large effect size (r=.63); a statistically significant difference (*p* = .01) was found between the V-Cut Agility pre-test and post-test with a large effect size (r = .63). In the control group, no statistically significant difference was found between 20 m. sprint pre-test and post-test and V-Cut Agility pre-test and post-test in both boys and girls. The effect size can be found by dividing the Z value by the square root of N. When evaluated according to Cohen's criteria (1988) (.1 = small, .30 = medium and .5 = large), the value obtained indicates a large effect size (Balcı & Ahi, 2020).

DISCUSSION

As a result of the study, a statistically significant difference (*p* = .02) was found between the 20 m. sprint pre-test and post-test, and a statistically significant difference (*p* = .04) was found between the v-cut agility pre-test and post-test of the girls experimental group. In addition, a statistically significant difference (*p* = .01) was found between the 20 m. sprint pre-test and post-test, and a statistically significant difference (*p* = .01) was found between the v-cut agility pre-test and post-test of the boys experimental group.

In their meta-analysis study, Cheatham et al. (2015) stated that SMR (self-myofascial release) used in warm-up improves joint range of motion without affecting muscle performance and reduces delayed muscle soreness after exercise.

Wu et al. (2021), in their meta-analysis study on myofascial release in chronic low back pain, stated that myofascial release (SMR) significantly improved pain and physical function in patients with chronic lower back pain, but had no significant effect on balance, pain pressure threshold, trunk mobility, mental health and quality of life.

Fauris et al. (2021) found that performing SMR in any segment of the SBL resulted in a statistically significant increase in hamstring flexibility and ankle dorsiflexion.

Carvalhais et al. (2013), in vivo their study on myofascial force transmission between latissimus dorsi and gluteus maximus, observed that due to contraction or stretching of latissimus dorsi, the force reaching the epimysium is transmitted to TFL (Tensor Fascia Late) and gluteus maximus through connective tissue continuity resulting in the muscle being pulled upwards. When the effects observed after stretching of the latissimus dorsi were analysed, it was stated that there was a functional relationship between the gluteus maximus and the hip joint. The results showing that force is transmitted from the latissimus dorsi to the gluteus maximus support the presence of myofascial force transmission This study supports the force transfer between the gluteus maximus, trocholumbar fascia and latissimus dorsi, which are the functional posterior line muscles that form the exercise choices.

In a systematic review, Krause et al. (2016) found that there is an indication that tension can be transferred between at least some of the adjacent myofascial structures. No studies were found to indicate force transfer between the gluteus maximus and vastus lateralis in the functional back line. In contrast, three studies reported force transfer between the latissimus dorsi and contralateral gluteus maximus, respectively, and a moderate force transfer at the TFL. For the functional anterior line, one study reported force transfer between the adductor longus and the contralateral distal rectus sheath, which was not statistically significant compared to baseline values.

Ajimsha et al. (2020) reported strong evidence for myofascial transitions in three of the six myofascial meridians examined in their study. These are; SBL, BFL and FFL. Myofascial transitions (plantar fascia-gastrocnemius, gastrocnemius-hamstrings and hamstrings-lumbar fascia/erector spine) were confirmed in fifteen studies. Three myofascial transitions in the BFL (latissimus-lumbar fascia, lumbar fascia-gluteus maximus and gluteus maximus-vastus lateralis) were confirmed in eight studies. Six studies were found to support two myofascial transitions (pectoralis major-rectus abdominis and rectus abdominis-adductor longus) for FFL with a 'strong evidence' rating. It is emphasised that the muscles in the fascial lines affect each other in biomotor abilities such as flexibility and strength and that exercise choices should be made accordingly. These evidences support the power and force transfer of the muscles between the BFL and FFL in this study.

Wilke et al. (2016) reported that lower extremity stretching based on myofascial chains increased cervical range of motion in their study. As a result, the existence of a stress transfer along the myofascial lines was pointed out.

Colomar, Baiget & Corbii (2020) examined the relationship between strength, power characteristics, individual muscle stiffness, international tennis number and stroke speed in young tennis players and found that higher stiffness values may increase stroke speed, especially when transferring power from the lower body to the upper body. It is thought that the arrangement of the functional myofascial line muscles and the exercises performed in conjunction with each other support the transfer of power from the lower body to the upper body during ball striking in tennis.

Core strength is related to the force and power produced by these muscles, whereas core stability refers to the capacity of the muscles to control trunk position and movement over the pelvis and leg to allow force production to the terminal segment in the integrated kinetic chain (Poór & Zemková, 2018). Functional myofascial line exercises look like core exercises. However, you can do core exercises in isolation by working the muscles, or you can include all core muscles in the movement and provide a total improvement in performance improvement. However, when choosing functional myofascial anterior or posterior exercises, an exercise is selected in which only the muscles in this line will be activated. The purpose of this is not to ensure the development of the muscles individually, but to ensure that they work efficiently while transferring force or power to the muscle group that should work together in a movement pattern. In other words, it is thought that the myofascial line exercises are not related to the development of the muscles, but the muscles are thought to be due to the efficient operation of the force and power transfer with the muscles in the myofascial line.

CONCLUSION

It can be said that the efficiency of the interaction of the muscles in the functional myofascial lines within the efficiency of the neuromuscular system to develop features that require fast reactions such as speed or agility can provide efficient results in performance.

Myofascia has an important role in joint range of motion. Trigger points formed in the superficial or deep fascia affect the flexibility of the muscle and accordingly the range of motion of the joint. Considering that the muscles in the myofascial lines affect each other, the trigger point of a muscle in this line may be inefficient in contraction at the moment of movement in line with the length-tension relationship due to its connection with each other. In this case, it can be said that it may also affect the muscles with myofascial connections working together with this muscle in the movement.

When exercising athletes are observed, it is noteworthy that isolated muscle exercises or exercises without paying attention to myofascial lines are usually performed in resistance exercise programmes. However, considering the interconnected joint movements during sportive activity and the movements in which many muscles are active at the same time in these joint movements, it can be thought that this coordination between muscles and myofascia may be impaired.

When designing resistance training programmes for athletes, it is thought that creating and implementing functional exercises by combining the biomechanical needs of the branch with myofascial lines will increase efficiency.

AUTHOR CONTRIBUTIONS

Study concept and design, drafting the article: Erhan Toprak Çağlın and Halil Orbay Çobanoğlu. Its critical revision: Halil Orbay Çobanoğlu. Data collection: Erhan Toprak Çağlın. Analysis: Halil Orbay Çobanoğlu. Final approval of the version to be published: Halil Orbay Çobanoğlu.

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