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The Relatıonship Between Functional Movement And Body Stability With Service Speed On Veteran Tennis Players

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Abstract

The purpose of this study is to investigate the effect of functional mobility analyse and body stability on service performance among veteran tennis players. 25 veteran (senior) players (X̄age: 40.79±4.2) who are active licenced, have participated in the study voluntarily. The analyse of body stability of participant group has been done by using 4 core endurance tests; plank test (PT), lateral bridge test (LBTdom./non-dom.), flexor endurance test (FET) and extensor endurance test (EET). The evaluation of the participant's mobility ability has been done with Functional Movement Screening test (FMS). Service performance scale has been conducted with Sports Radar Speed Gun SR3600. Participants have been asked for serving 8 times at maximal speed, the shots would be aimed at the cross service box with the dominant hand, accordingly with the tennis rules, balls which are hung to the net and out of service court (out) have been invalidated. Spearman Rank Order correlation analyse has been done on the gathered data by considering normality distribution at SPSS for windows 20.0 programme. In conclusion; a relationship couldn't be found between the FMS and service performance speed rates of veteran (senior) tennis players. While it has been seen that there is a relationship between service performance speed and from the body stability core endurance tests; LBT (dominant), ($p<0,05$; $r=0,550$) FET ($p<0,05$; $r=0,426$) and EET ($p<0,05$; $r=0,460$), a relationship between PT and LBT(non-dom.) and service performance and between FMS and body stability core endurance tests hasn't been encountered. A healthy psychical structure with a wide range of mobility can contribute to the performance of a variety of sport branches including tennis. When the role of service performance in a tennis match has been taken into account, it has been considered as one of the most important part of a play. For the studies that can be done in the future, with increasing the number of subjects, also using video analyse system can be recommended.

Keywords: Tennis, Tennis Service Performance, Functional Movement Screen, Body Stability

INTRODUCTION

Today, tennis, which attracts the attention of many people, is preferred as a sports branch that appeals to a remarkable audience by increasing the number of spectators and actors (31). Tennis, which is a sports branch that can appeal to all age groups, continues its development and population, as well as creating positive health effects for individuals of all ages and has become a sports branch that contributes to mental and physical development by showing its positive physiological and psychological advantages (31, 35).

Tennis is also considered as a racket sport that requires good physical strength. One of the key points in increasing the success level of athletes is due to their physical fitness being at the highest point possible. An athlete with maximum physical fitness reflects the technical and tactical skill components on the field in the best way (33). At the same time, the desired level of physical strength is

one of the most important factors affecting the result of the competition. For this reason, it is an important guiding factor to evaluate the physical properties and act according to this situation for the athlete. The high level of physical fitness in this sport has a positive effect on the athlete in the nature of tennis, such as rapid changes of direction, fast and strong arm movements and jumps, and reflects on the field as a performance enhancer (1, 8, 10). Considering such situations, the importance of evaluating sportive performance increases for researchers (47). A healthy physical structure is extremely important for the athlete to increase performance. Having an injury-free season will provide a great advantage in terms of athlete performance.

Experts have recently developed some methods to minimize the risk of disability (38). One of them is functional movement analysis developed by Cook et al. (2006). Although it has more than one evaluation area, it is used to determine whether there is a risk of disability in individuals. At the same time, although it meets an important expectation in determining the general functional performance of the athlete, it is considered as a comprehensive test that examines the basic movement patterns (19, 28). Another issue that the researchers who work on the subject aim to solve while applying the functional movement analysis on the athletes is to examine the individual asymmetric structures of the athletes and to evaluate the stabilization and mobilization situations that create the movement (44). The importance of the core zone also becomes evident in stabilization and mobilization situations.

Core muscles are seriously important as they act as a protective mechanism in protecting the spinal cord from unhelpful and unexpected forces in the prevention of a disability-like adverse situation and in basic movement patterns. The core is defined in most literature as the lumbo-pelvic-hip complex, as well as the midpoint of our center of gravity and the place where movements begin. Another explanation of the definition of core is defined as the spinal part being supported by the abdominal and spinal muscles at the time of movement and moving to its active position and maintaining this condition (14, 15).

The central core has a serious functional importance in providing stabilization in the athlete's body (41). All movements start from the core region before transferring to the extremity that will apply the movement. Evaluation of the strength and stability of the core region, which is the power transfer process between the upper part of the body and the lower part shows parallelism how strong your athlete will be (32). While evaluating the performance of the athlete, core stabilization, which is at the maximum level possible, supports the upper and lower extremities to reach such high strength values (42).

The muscles in the core are a factor that will reflect on the athlete's mobility in the court (15). Considering the importance of the core region in branches such as tennis where there is a sudden change of direction, swings, rotations and jumps are quite high during the game, however, in branches such as tennis where overhead throws are important, core stabilization and strength become undeniably important (42).

The service shot, which we consider as the beginning of the game when it comes to overhead shooting in tennis and which can also affect the outcome of the match in tennis, is an extremely important component for tennis players. A very good service shot is associated with a strong shooting action. The most important goal in the service shot is to send the ball to the opposite court at maximum speed. In this case, the player can move directly to get the point. It is important not to disrupt the coordination of the leg and arm muscles as well as the abdominal, chest and back muscles in order to throw the service shot as quickly as possible. (4, 18, 20, 45).

Today, tennis is not only a sport branch performed by elite players, but it is a game played with interest from young age groups to veteran players who have reached a certain status. Considering the literature in our country, there are studies on elite and young age groups dealing with tennis. (13, 42). However, in the accessible literature, there has been no previous study on veterans (seigneur) tennis players. Evaluating the requirements of tennis in terms of a healthy body

and performance in tennis may also be important for veteran tennis players.

The service shot, which is one of the important parts of the game during tennis competition, can earn the player points directly with a powerful shooting action. The good mobility of a healthy body and the level of functional performance can be considered as important parts in the service shot. At the same time, the core region, which is known as the starting point of movements in many sports branches such as service shooting, and is in good condition, can also perform the task of stabilizing the body and successfully reveal the movements and performances depending on the movements. Based on these considerations, this study aimed to investigate the relationship between functional movement and body stability with service speed.

MATERIAL AND METHOD

Study Group

25 active male veterans (seigneur), (Xage: 40.79 ± 4.18 years; XSport age: 15.75 ± 5.47 years; X Height: 178.79 ± 6.00 cm; XWeight: 81.00 ± 5.6 kg; XBMI (kg / m^2) 25.33 ± 1.93), who are licensed by the Turkish Tennis Federation, who have at least 7 tournament experience, who play tennis for at least 6 hours a week and who have been approved that they do not have any health and disability problems, and who are willing to participate in the study, participated in the study.

Collection of Data

After the participants were informed about the purpose of the study, the method of application of the tests was shown and explained.

FMS measurements of the individuals participating in the study were carried out without any warming and adhering to the order in the test procedure. After each test of functional movement screen tests was explained to the participant verbally and visually, 2 trials were given for each test.

Before the body stability tests, the individuals were given a 10-minute warm-up period, and then the test phase was started. After the core durability tests were explained to the participant verbally and visually, the shape of the body position during the tests was shown.

Before evaluating the service speed, the participant was given a 10-minute warm-up period specific to tennis and service shots. After the player completed the warm-up time, he was asked to serve 8 services to the cross service box by the dominant hand. At the end of 8 services, the service shot with the maximum value in terms of speed from the successful services (not getting the ball caught in the net and throwing it into the desired service box) was taken into consideration.

Taking into account the effects of weather conditions, service speed measurements were made on the closed court. All measurements were made by the same person in the indoor courts of Sakarya Tennis Club.

Data Collection Tools

Height, body weight and body mass index measurement

Height measurements were taken using the Seca brand portable height meter. Body weight and body mass index measurements were measured using the Tanita BC 545 N InnerScan easily portable body composition measuring device (28).

Functional movement analysis test (FMS)

This test consisting of 7 test protocols; 1-deep squat, 2-hurdle Step (bilateral), 3-inline lunge (bilateral), 4-shoulder mobility (bilateral), 5-active straight-leg raise (bilateral), 6-trunk stability push up, 7-rotary stability (bilateral), performed using a special test kit, developed by Gray Cook, evaluated over 21 points is applied according to the sequential procedure specified. At the same time, after tests of shoulder mobility (bilateral), trunk stability push up, rotary stability (bilateral) the clearing test was applied. Cleaning and control tests are tests that are evaluated with control movements specific to the test for the presence of pain and any problems after the movements of the test are completed (39). Test participant did 2 trials before each test, and then did 3 repetitions in each test evaluated for scoring (30). The score given to the participants is between 0-3 in each test. 3 points are given when the movement is done exactly as desired, 2 points when there are

some disruptions in the movement, 1 point when there are disruptions in most of the movement, 0 point is given if pain is felt during the movement.(25, 40). The lowest score was evaluated in the tests performed bilaterally (36, 43).

Body stability core endurance tests

These tests, developed by McGill et al., are used to evaluate the strength of core muscles and their ability to maintain their position during these test movements. (2, 9). At the same time, these tests are also used when evaluating the possibility of injury in the core region, evaluating the specific performance of any branch and examining the relationship between performance and core strength (23, 24).

Plank test (PT): The person participating in the test was positioned on his toes and elbows, the feet took the shape of plantar flexion and the whole body was made straight. The person participating in the test was positioned on his toes and elbows, the feet took the shape of plantor flexion and the whole body was made straight. It was recorded taking into account the time that the person held the position (2, 17).

Lateral bridge test(LBT): The person participating in the test was placed on his side, standing on his elbow, allowing the hip and body to take a stable position with one foot on the other. It was recorded taking into account the time to keep the current position. This test was done on both parts of the body, right and left (17, 27).

Flexor endurance test (FET): The person included in the test was asked to touch his shoulders by positioning his hands in a cross. The body was lifted close to the sitting position at an angle of 90 degrees parallel to the floor and the hip was brought to the flexion position. At this stage, both knees were brought to 90 degrees of flexion. The period that the person could stand while maintaining this position was taken into account (3, 21).

Extensor endurance test (EET): The person participating in the test was laid face down on the table with the support of the foot and calf section and taken into the space, including the body from the iliac part to the head level. Hands were placed crosswise to touch the shoulder. The foot section is fixed. The time that the person could stand in this position was taken into account by evaluating the stopwatch (6, 37).

Service Speed Measurement

Service speed was measured with Speed Gun Radar 3600 device. While the person applying the test was performing the service shot, service speed was measured at an angle of 10 degrees from 2 meters behind the participant towards the section where the service would be shot, taking into account the height (48).

RESULTS

Body stability of the study group, descriptive statistics on FHA and service speed, the correlation results between service speed and body stability tests and FHA are shown in Table 1 and Table 2, respectively.

Table 1. Descriptive Statistics of the Participants

	n	Mean	SD	Min	Max
Body stability (sn)					
PT	25	72,46	31,51	49,68	220,82
LBTdom	25	60,35	13,89	40,17	90,1
LBTnondom	25	53,65	11,22	33,9	72,74
FET	25	35,65	7,87	18,75	49,64
EET	25	77,18	27,81	38,47	172,58
FMS (point)	25	15,96	2,51	10	20
Serve speed (km/h)	25	140,16	12,50	121	170

Table 2. The Correlation Table Of Serve Speed and Body Stability and FMS			
	Serve Speed		
	r	R^2	p
Body stability			
PT	0,11	1,32	0,58
LBTdom	,550**	30,2	0,00443*
LBTnondom	0,39	15,18	0,054
FET	,426*	18,19	0,033*
EET	,460*	21,18	0,020*
FMS	0,16	2,43	0,46

When looking at the results, the service speed and the lateral bridge dominant, ($p < 0.05$; $r = 0.550$) Flexor endurance ($p < 0.05$; $r = 0.426$) and Extensor endurance ($p < 0.05$; $r = 0.460$) are seen that there is a positive significant relationship at the level. There is no relationship between service speed and Plank test and lateral bridge non-dominant tests (p>0,05).

As a result of the obtained results, it is seen that there is no relationship between service speed and functional movement analysis. (p>0,05).

Since the functional movement analysis test scoring is stated in the literature that the FMS score should be above 14 in order to reduce the risk of injury (46), it is divided into two as tennis players with 14 points or less and those above 14 points and the difference expressing the relationship between these ratings and service speed is shown in Table 3.

Table 3. Correlation Table Between Serve Speed and FMS 14 Point or Less and Above 14						
	FMS (score)	n	Serve Speed (km/s) X	SD	Z	p
Serve Speed and FMS	***14 point or less***	9	137.8	11.02	-652	0.514
	above 14	16	141.5	13.80		

Considering the results, a significant difference was not observed between the tennis players with a score of 14 points or less on the Functional Movement Screen test and the service speed of the tennis players with a score above 14 points (p>0,05)

The correlation analysis between the service speed and the functional movement analysis and core endurance tests whose effect is to be investigated is shown in Table 4.

Table 4. Correlation Table Between FMS and Body Stability Tests						
		PT	LBT*dom*	LBT*nondom*	FET	EET
FMS	**r**	0,045	0,35	0,10	0,12	0,28
	R^2	0,20	12,17	0,97	1,49	8,17
	p	0,83	0,087	0,64	0,56	0,17

It was found that there was no relationship between any of the functional movement analysis and body stability tests.

DISCUSSION

Serving in tennis is one of the most important parts of the game. The player with a strong serve has a significant advantage in the game (5). A maximum level of service shot is about a powerful shot and the quality of the movement dynamics that make that shot (45). Considering the service shooting kinematics, body stabilization, lumbo pelvic and core region is an important area for service throw, but also has an important place in the movements inherent in the service by affecting the development of strength, distal mobilization and proximal stabilization (22). In addition, having a good level of body stabilization minimizes possible injury risks (16). While serving in tennis is the most important part of the game, it is also considered as the heaviest shot. Coaches strive to avoid the risk of injury in development work to take the service to a better level (29). Functional movement screen, which is frequently used today in order to predict these injuries and then take the necessary measures, is also a test tool for evaluating many movement components. Functional movement screen is a test protocol to be used in many sports branches, including tennis (12). Elements such as lower extremity, upper extremity, body and rotation of the

body are very important in the service shot (11). Functional movement analysis stands out as an important tool in evaluating the effectiveness of working limbs and regions while performing these movements. Having the service performance at the maximum level after being able to estimate the risk of injury and taking the necessary precautions and bringing the mobility to a good point is one of the important components (29). The aim of this study is to investigate the effect of body stabilization and functional movement analysis on service speed on veteran tennis players. In conclusion, when the results were evaluated, while there is a moderate relationship between the LBTdom., FET, EET and service speed ($p < 0.05$), there is no relationship between PT, LBTnon-dom. and service speed.($p>0,05$). There is no relationship between functional movement analysis and service speed. ($p>0,05$). No relationship has been found between FMS and body stability tests performed to evaluate the relationship between service speed and them. ($p>0,05$).

While studies that directly examine the relationship between body stabilization and service speed are not found in the accessible literature, after measuring service speed, certain core training programs were applied and it was examined whether there was a change in service speed at the end of the training program. In one of these studies, 24 tennis players in the 11-13 age range with an average age of 11.9 were divided into two, as 12 training group and 12 control group. After the service speed measurements were made, an 8-week periodized core training protocol was applied, and then service speed was measured again. In this study; conducted on two groups divided into training group and experiment group, the service speed of the experimental group did not change, while the average service speed of the group included in the 8-week core training program varied by approximately 8 km/h. (42). However, when this study is compared with the mentioned study, the importance of age groups is also revealed. If the skill learned at a young age is gotten stronger than the skill to be learned at an advancing age, the improvement in performance can be noticed by applying the correct training methods (such as core training) with the right technique.When we think that the active functioning of the muscles is negatively affected as the age progresses (Ackland et al., 2009), better information can be obtained from the results of the measurements made after the studies are started as early as possible and continued at an advanced age as much as possible. In another study similar to this subject, 30 tennis players at the age of 13 who participated in national level competitions were applied core training 3 times a week for 6 weeks, as well as different training methods (such as pliometric). The service speed of the players was checked before and after training. As a result, in the mentioned study, it is interpreted that core training and other training methods (such as pliometric) caused an increase in the service speed of the players (12). The results of these studies are that the core training program will affect the service speed. Looking at this study, a moderate relationship was found between the LBTdom., FET and EET and service speed. There was no relationship between PT and LBTnon-dom tests and service speed.

The core training program to be made for veteran tennis players and its relationship with service speed at the end of this program can make the findings of this study more understandable.

In another study, hobby tennis players with a mean sport age of 3,4 years were divided into two as the control group and the study group after measuring their service speed, and core training methods were applied to the study group for 8 weeks. Although the core strength measurements made in the pre-test increased in the study group after the post-training tests, no significant relationship was found with the service speed after the training procedures. At the end of this study, it was concluded that core training could not only positively affect the service speed, but could be improved with the coordinated work of the lower and upper body strength and the involvement of other fitness elements (Smart et al., 2011). In order to make a better interpretation of the relationship between some tests performed in our study and service speed (LBTdom., FET and EET), and some lack of relationship (LBTnon-dom), during the service, correcting technical errors, if any, and increasing the number of participants participating in the study and making the measurements later can give more supportive information about the result.

In a study, anterior abdominal strength test and side abdominal strength test, lower and upper body angular velocities were applied to 24 tennis players between the ages of 12 and 19, and the racket speed values in contact with the ball were taken. Later, the athletes were included in the 5-week lumbo-pelvic

stabilization training program consisting of 5 levels. The tests, which were first performed again after the training program, were applied to the athletes. As a result of the study, it was concluded that at the end of the Lumbo pelvic stabilization training, an increase was observed in the tests applied on the athletes and that the service speed was also positively affected by affecting the contact speed of the racket with the ball (7). In addition to overhead shots and core training such as service shots, the relationship between throwing and throwing sports and shooting and core training methods was examined. 3. league baseball team players were divided into two groups, one group applied closed and open chain exercises training procedure, and one group applied an extra core stabilization training program. At the end of the study, the throwing rate of baseball was found to be higher in the group that did extra core training (26). During the service shot in tennis, considering that power generation in body rotation and energy transferred to the extremities in the kinetic chain (11), when evaluating the body's position of entry into rotation in the move made after throwing the ball into the air during the service in tennis, it can be thought that the applied core training procedure may cause more acceleration by affecting the rotation speed of the body and then an increase in the service speed with the greater force transferred to the ball.

In the available literature, there is no study investigating the relationship between FMS and tennis service, overhead shooting or throwing sports branches. Regarding this situation, FMS athletes may not give healthy results in terms of evaluating strength and performance, it is commented that explaining the relationship between FMS and performance is a complex situation (30,34). When we look at the results of our study, although the mean service speed of the participants whose average score of the FMS test was considered as 14 points, was higher than the participants with 14 points or less, no significant difference was observed between the two groups considering that the FMS subtests are performed slowly and in a controlled manner, and considering that the service shot technique in tennis is performed at maximum speed, it can be said that there are different movement speeds between the two situations.

One of the studies investigating the relationship between core stabilization and functional movement analysis included male and female groups consisting of 28 people with an average age of 24, who did various sports as a hobby and did not have a disability problem. At the end of the study, there was no relationship between core stabilization and functional movement analysis test. One of the comments made about the results of the study is that people with a strong core muscle structure may get low scores on the FMS and at the same time, the opposite opinion is that people with a weak core stabilization structure may have high success in FMS. Another comment is that explaining the relationship between performance and FMS and core stabilization is considered a complex situation (30). When we look at our study, no relationship was found between functional movement analysis and body stability core endurance measurements. The findings obtained are in parallel with the study.

Service shot is one of the most important elements in the game of tennis. The maximum level of service performance can be considered a great advantage for the players during the game.

During the service shot, which is considered one of the heaviest and most valuable shots of the tennis game the application of incorrect technique can be misleading for many studies (29). For this reason, the application of video analysis method together with the core measurements to be made in the future studies, and if there is a mistake made by the player based on the technique, the measurement results to be made after improving this error in the right direction and the effect of these measurements on the performance can be understood better.

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