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The Acute Effects of Chiropractic Sacroiliac Joint Manipulation in Tennis Players: A Study on Core Muscle Strength

Serhat Koran[1], Aydın Sarıhan[2*]

Asist. Prof. M.D. İstanbul Medipol University Hospital, Department of Family Medicine, Istanbul-TURKEY[1]
Manisa Merkez Efendi State Hospital, Department of Emergency Medicine, Manisa, Turkey[2]

Corresponding author: 2*

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ABSTRACT

The purpose of this study is to investigate the acute effect of chiropractic sacroiliac joint manipulation on core muscle strength in tennis players. 65 tennis players were approached for the study. A total of 50 tennis players with an average age of 47.8±11.4 who met the inclusion criteria and agreed to participate in the study were enrolled. After recording their sociodemographic information and time spent playing tennis, a test for abdominal and back core strength was conducted. Then, chiropractic sacroiliac joint manipulation was performed. A final test was conducted afterwards. The initial and final tests were performed by different chiropractors. The measurements for core muscle strength (abdominal and back) were performed using the Chattanooga Stabilizer Biofeedback Pressure device. Significant differences were found in abdominal and back core scores after chiropractic manipulation ($p<0.05$). Although males had higher back and abdominal core scores compared to females, this difference was not significant ($p>0.05$). Similarly, males had a longer time spent playing tennis than females, but this difference was not significant ($p>0.05$). Our study results indicate that core muscles, which are important for the health and performance of athletes, can be strengthened through chiropractic practices.

1. Introduction

Tennis is a sport that requires high motor and coordination abilities, incorporating rhythm, reaction, kinetic differences, balance, and temporal discrimination. [1]. Tennis is a sport that is played with two or four players and involves striking the ball with a racket [2]. It is reported that 83 million people around the world play tennis, with 4,000 of these people being considered elite in this sport [3].

Core muscles are 29 pairs of deep muscle groups located in the depths of your body, stretching from the base of your head to your pelvis, including hip and pelvic muscles, diaphragm, glutes, paraspinal muscles,

and abdominal muscles. They help coordinate movements effectively and efficiently by balancing your body and coordinating the movements of your arms, legs, and spine [4].

Physical therapists, doctors, and chiropractors aim to reduce and/or prevent mechanical back pain and increase athletic performance by strengthening and increasing the endurance of core muscles. The core is referred to as the area that connects the upper and lower extremities and plays an important role in transferring power to the appendicular skeleton. The core muscles play a crucial role in movements of the upper and lower extremities. Despite the fact that most studies on core muscles are related to injuries, in recent years, there has been an increase in the number of studies aimed at identifying the relationship between core muscles and athletic performance [5], [6].

The lack of standardization in core strength and stability measurements is thought to be the reason for the limited studies on the relationship between athletic performance and core strength and stability [7].

This is because having optimal core muscle strength is crucial for tennis players, as it helps to improve their athletic performance and reduces the risk of injury. Additionally, a strong core helps to provide stability and support to the upper and lower extremities, allowing for efficient and effective movement during tennis shots [8]. It is important for tennis players to have optimal core muscle strength, as tennis is not a one-dimensional game and players need to constantly change their body positions to hit the ball as desired. One aspect of tennis strategy involves requiring the opponent to become unbalanced, leading to frequent changes in all directions during the match. Improved core muscle strength and stability enhances dynamic balance and functional power, thereby enhancing tennis performance. This has been reported to be active during tennis techniques such as serving and forehand and backhand [9], [10].

Chiropractic has existed for more than a century, however, different forms of manipulation have been used in the treatment of diseases from ancient times to the present. The exact starting date is not known, but it is believed to have been used 4000 years ago and to be based on Thai art. It is known that manipulation was used in the treatment of diseases in ancient Egypt, China, Japan, and Tibet. Manipulation has also been used as part of the Indian culture outside of North and South America. In particular, Hippocrates (460-355 BCE) is known to have used manipulation techniques for spinal deformities [11].

Chiropractic is a healthcare profession that focuses specifically on the treatment, diagnosis, and prevention of musculoskeletal and nervous system disorders, with a focus on subluxation. The profession uses manual techniques to adjust and manipulate joints to improve the overall health effects of these disorders on the body [12].

The World Federation of Chiropractic (WFC) defines chiropractic as a healthcare profession that focuses on diagnosing, treating, and preventing mechanical disorders of the musculoskeletal system, and the effects of these disorders on the nervous system and general health, with a specific focus on correcting pathological joint biomechanics and facilitating the body's natural healing process through manual techniques [13]. Although the positive effect of chiropractic treatments applied for sacroiliac joint dysfunctions has been emphasized in many studies, there is no study found in literature that investigates the effect of chiropractic treatments on the core muscle strength [14].

In this study, the effect of chiropractic sacroiliac joint manipulation on the abdominal and lower back core muscles of tennis players will be investigated.

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2. Material and Methods

2.1 Study design and settlement

The study aimed to determine the acute effect of chiropractic sacroiliac joint manipulation on core muscle strength in tennis playing athletes, and was conducted between the dates of August 1st, 2022 and September 1st, 2022. The study was approved by the local Non-Interventional Studies Research Ethics Committee (Ethics Committee Number: 10840098-604.01.01-E.63150).

2.1.1 Study Population

A total of 50 (15 females and 35 males) tennis playing athletes, who agreed to participate from a pool of 65 registered athletes at a club, were included in the study. Participants were informed about the content, purpose and treatment to be applied in the study and written consents were obtained.

Inclusion criteria for the study:

a) Being a tennis athlete,
b) Being healthy (not having any injuries or disabilities),
c) Not having undergone any surgery in the past six months,
d) Being between the ages of 18 and 60.

Exclusion criteria for the study:

a) History of traumatic injury to the sacroiliac joint,
b) Cancer patients,
c) Bone tumors,
d) Osteoporosis,
e) Rheumatic diseases,
f) Neurological diseases (multiple sclerosis, stroke, Parkinson's disease),
g) Down syndrome,
h) Neoplastic diseases of the muscle or soft tissue,
i) Pregnancy,
j) History of fractures in the spine and hip,
k) Individuals with abnormal neurological history,
l) Individuals with acute fractures,
m) Individuals with spinal cord tumors,
n) Individuals with meningeal tumors, aneurysmal bone cysts, and abdominal aortic aneurysms.
o) Individuals under the age of 18.

The participants' sociodemographic information (height, weight, gender, age, body mass index) and length of time participating in sports were recorded. Participants were instructed to not engage in any physical activity on the day of the test and to be fully rested, and to have eaten at least 3 hours prior.

2.1.3 Application of Manipulation

Manipulation was carried out using a manual method that involves applying a force to the facet joints to create a gliding movement without exceeding the physiological range of motion or anatomical limits. This is in accordance with the definition of "manipulation" as described in the manual produced by the World Health Organization (WHO) on basic education and safety in chiropractic. The individual lay on the table in a supine position with their arms crossed and legs straight, with the upper leg positioned over the lower leg behind the knee, while the lower leg was positioned flat on the table (Figüre 1).

Figure 1. Application of chiropractic sacroiliac joint manipulation

The manipulation was applied with a low force and high velocity. After the test was administered to the participants, chiropractic manipulation was performed under the control of a physician and the test was performed again approximately 15 minutes later. Initial and final tests were performed by two different chiropractors. The core muscle strength measurements (abdominal and back) were carried out using the Chattanooga Stabilizer Biofeedback Pressure device. All participants underwent the tests and manipulation on the same day, and the results were recorded on pre-prepared forms. The device was filled with a certain amount (20 mm Hg) of air, and the participant was instructed to contract their muscles by placing it in the abdominal cavity and under the belly, and the resulting value was recorded (Figüre 2.

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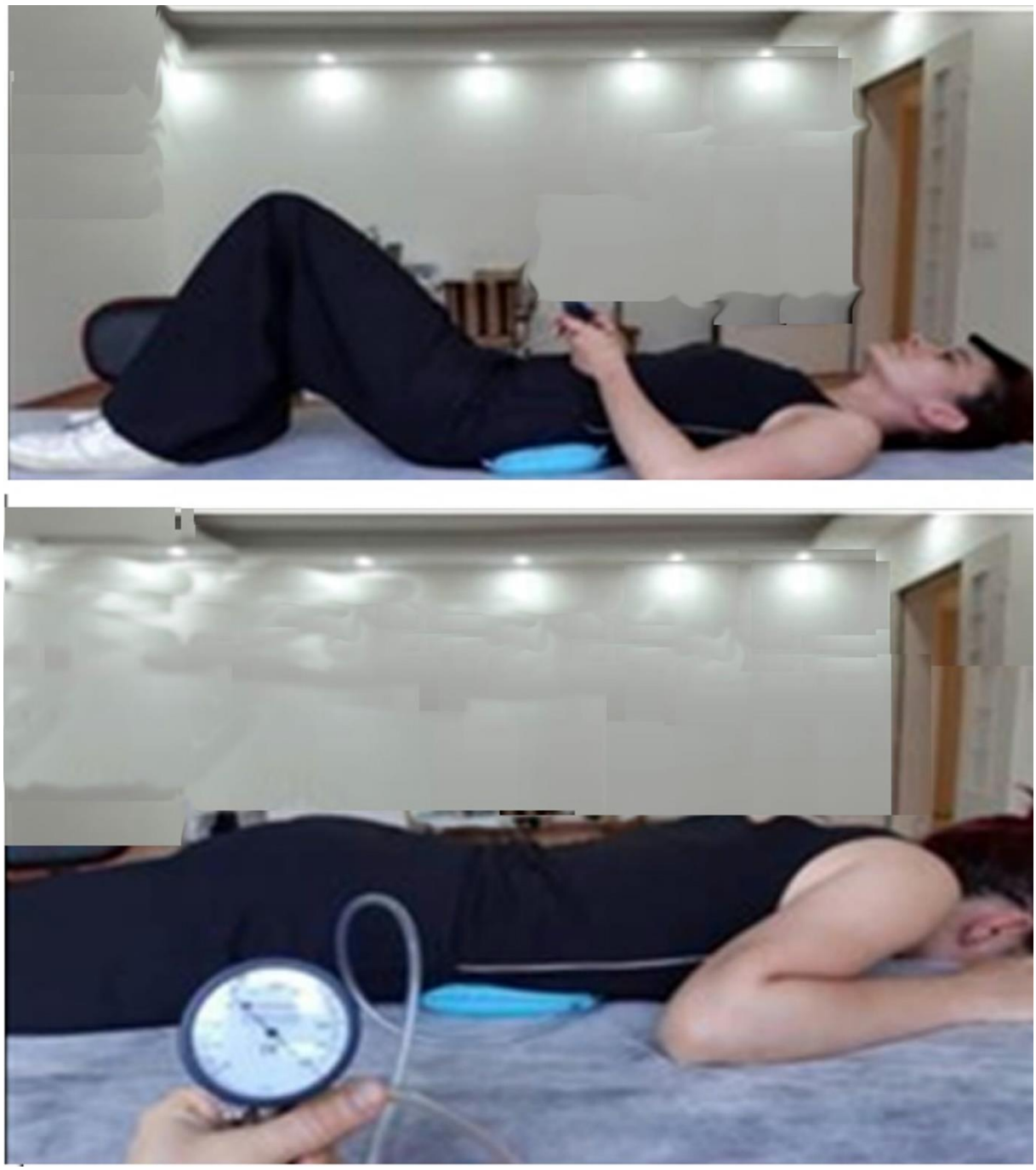

Figüre 2. The difference between the pre and post-kayropractic sacroiliac joint manipulation was recorded by performing the same procedure again after the manipulation.

2.2 Statistichal analysis

The normality of the variables was analyzed using analytical methods (Kolmogorov-Smirnov). Descriptive analyses were provided using minimum values, maximum values, means, and standard deviations for demographic characteristics. For intra-group comparisons, a dependent sample t-test was used, and for comparison of variables between independent groups, an independent t-test was used. A one-way ANOVA test was used to compare variables between groups. The relationship between the evaluation parameters of the participants was analyzed using Pearson's Correlation test. The statistical analyses were performed using SPSS version 22.0 software. The results of the study are considered statistically significant when the p-value is less than 0.05.

3. Results

The participants of the study had a mean age of 47.8 ± 11.4 years. The participants were aged between 18 and 59 years old. The mean height of the participants was 173.2 ± 7.58 cm, with the shortest height at 158 cm and the tallest at 183 cm. The body weight of the participants ranged from 50 to 150 kg, with a mean of 76.7 ± 14.0 kg. Body Mass Indices (BMI) ranged from 19.5 to 32.1, with a mean of 25.4 ± 3.43 kg/m2. Approximately half of the participants (51.1%) had a normal range of BMI (18.5-24.9 kg/m2). 36.2% of the participants were slightly overweight (BMI: 25-29.9 kg/m2) and 12.8% were obese (BMI>30 kg/m2)

The difference in abdominal core score and lumbar core score between pre-treatment and post-treatment values of the participants is shown in Table 1. The average abdominal core score after treatment showed a statistically significant increase. Similarly, the lumbar core score value after treatment also showed a statistically significant increase ($p<0.05$).

Table 1. Examination of the difference between the pre- and post-treatment values of the participants' abdominal and lumbar core scores

		Mean ± SD	p Value
Abdominal core score	Before treatment	63.3 ± 15.6	.000
	After treatment	68.2 ± 18.0	
Lumbar core score	Before treatment	80.0 ± 24.1	.000
	After treatment	90.8 ± 25.1	

The comparison of the age and anthropometric measurements of the participants with the pre-treatment core scores and the changes in the treatment and core scores are given in Table 2. A weak negative correlation was found between age and pre-treatment luber core score ($r= -.343$ $p<0.05$). On the other hand, no statistically significant relationship was found between age and pre-treatment abdominal score ($p>0.05$). Similarly, a weak negative correlation was found between the weight of the participants and the change in the lumbar core score after the treatment ($r=-.366$ $p<0.05$). However, there was no statistically significant difference between the change in the abdominal core score of the treatment and the weight of the participants ($p>0.05$). A weak positive correlation was found between the height of the participants and their pre-treatment abdominal core scores ($r=.375$ $p<0.05$). A weak negative correlation was found between BMI values of individuals and lumbar core scores after treatment ($r=-.366$ $p<0.05$).

Additionally, a weak negative relationship was found between the participants' weights and the change in their lumbar core score after treatment ($r=-.366$, $p<0.05$). However, no significant difference was found between the change in abdominal core score due to treatment and the participants' weights ($p>0.05$).

Table 2. Comparison of the participants' ages and anthropometric measurements with pre-treatment core scores and changes in treatment and core scores

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		Abdominal core score before treatment	Abdominal core score score with treatment change in score	Lumbar core score before treatment	Lumbar core score with treatment change in score
Age	Correlation coefficient	-.205	-.231	-.343*	-.194
	p-value	.167	.118	.018*	.190
Weight	Correlation coefficient	.302*	-.115	.006	-.366*
	p-value	.039*	.443	.969	.011*
Height	Correlation coefficient	.375**	.023	.188	-.210
	p-value	.009*	.877	.206	.157
BMI	Correlation coefficient	.192	-.154	-.088	-.366*
	p-value	.195	.300	.558	.011*

4. Discussion

The importance of focusing on the core area in exercise training has been emphasized in many studies because the core muscules plays an important role in transferring power to the appendicular skeleton [15]. [16] observed that there was no significant relationship between corstabilization and performance tests (sprint, vertical jump and agility) in their study on male football players [17]. In our study, it was determined that the abdominal and lumbar core scores of male tennis players were higher than female tennis players, but this situation was not statistically significant. In the study by [17], in which they investigated the relationship between the physical activity level of university students and their core endurance time, they found the core endurance of men to be higher than that of women, similar to our study. [18] investigated isometric muscle endurance test norms in 471 university students and found that male students had significantly longer plank test times than female students. The results of our study support the literature. [17] evaluated the core muscles with plank and side plank tests in their study in 2016. Parallel to the results of our study, they did not find a significant relationship between BMI and plank and side plank tests. On the other hand, in the same study, a weak positive correlation was found between BMI and physical activity

level. In our literature research, the effect of chiropractic sacroiliac manipulation on core muscle strength was not investigated before. In our study, it was determined that the abdominal core score and lumbar core score of the participants increased significantly after the treatment compared to the pre-treatment values [19]. In our study, it was found that abdominal and lumbar core scores increased with chiropractic sacroiliac joint manipulation. Studies are needed to investigate the long-term effect of chiropractic sacroiliac joint manipulation on core strength.

In our literature review, we did not find any study investigating the acute effect of chiropractic sacroiliac joint manipulation on core muscle strength. This constitutes the original side of our work.

6. Limitations

Failure to look at the long-term effect of chiropractic sacroiliac joint manipulation limits the study. The small number of participants and the inhomogeneity of the demographic distribution are also among the limitations of the study.

7. Conclusion

As a result, it is thought that conducting studies investigating the long-term effect of chiropractic sacroiliac joint manipulation with more participants who do sports in different branches in future studies may bring a different perspective to the subject and change the degree of significance of the homogeneous distribution of demographic characteristics.

Conflict of interest disclosure:
The authors and participating institutions have no conflicts of interest related to this article. No funding was received to support data acquisition or preparation of this position paper. The research data is confidential and unsuitable.

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