

STRENGTH TRAINING IN THE ABDOMINAL CORE OF TENNIS PLAYERS

TREINAMENTO DE FORÇA NO CENTRO ABDOMINAL DOS JOGADORES DE TÊNIS

ENTRENAMIENTO DE FUERZA EN EL NÚCLEO ABDOMINAL DE LOS TENISTAS



ORIGINAL ARTICLE
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ABSTRACT

Introduction: Tennis players often participate in large-scale competitions, requiring a stable pattern of play to achieve the best results. This sport style requires great strength of the abdominal core because this strengthened muscle group will play a key role in the motor skills of the sport, such as force conduction, support stabilization, and sports posture. **Objective:** Study the most effective training to improve the abdominal core strength of tennis players by experimentation. **Methods:** Fuzzy mathematics was used to determine the degree of correlation between various factors of abdominal core strength in tennis players and their various training methods, formulate abdominal core strength training plans, and conduct the targeted training. **Results:** Statistical analysis of the tests before and after the experiment found that the P value of the special test group was distributed between 0.000 and 0.004, and the P values were all shown to be less than 0.005. There was a significant difference in the experimental group's performance before and after the experiment. **Conclusion:** The experimental training revealed a positive effect on the experimental group's tennis-specific performance and the strength of the abdominal core. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Resistance Training; Tennis; Abdominal Core.

RESUMO

Introdução: É frequente a participação dos jogadores de tênis em competições de larga escala, exigindo um padrão estável de jogabilidade para alcançar os melhores resultados. Esse estilo esportivo exige grande força do centro abdominal pois esse grupo muscular fortalecido desempenhará um papel fundamental nas habilidades motoras do esporte como a condução da força, estabilização de apoio e postura esportiva. **Objetivo:** Estudar o treinamento mais efetivo para melhorar a força do centro abdominal dos jogadores de tênis por experimentação. **Métodos:** Foi utilizada a matemática difusa para determinar o grau de correlação entre vários fatores da força do centro abdominal nos tenistas e seus vários métodos de treinamento, formular planos de treinamento da força central e conduzir os treinamentos direcionados. **Resultados:** A análise estatística dos testes antes e depois do experimento constatou que o valor de P do grupo de teste especial foi distribuído entre 0,000 e 0,004, e os valores de P mostraram-se todos inferiores a 0,005, houve uma diferença significativa no desempenho do grupo experimental antes e depois do experimento. **Conclusão:** O treinamento experimental revelou um efeito positivo sobre o desempenho específico do tênis e na força do centro abdominal do grupo experimental. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Treinamento de Força, Tênis, Centro Abdominal.

RESUMEN

Introducción: Los jugadores de tenis suelen participar en competiciones de gran envergadura, que requieren un patrón de juego estable para conseguir los mejores resultados. Este estilo de deporte exige una gran fuerza del núcleo abdominal, ya que este grupo muscular fortalecido desempeñará un papel fundamental en las habilidades motoras del deporte, como la conducción de la fuerza, la estabilización del apoyo y la postura deportiva. **Objetivo:** Estudiar el entrenamiento más eficaz para mejorar la fuerza del núcleo abdominal de los tenistas mediante la experimentación. **Métodos:** Se utilizó la matemática difusa para determinar el grado de correlación entre varios factores de la fuerza del núcleo abdominal en tenistas y sus diversos métodos de entrenamiento, formular planes de entrenamiento de la fuerza central y realizar los entrenamientos dirigidos. **Resultados:** El análisis estadístico de las pruebas antes y después del experimento encontró que el valor P del grupo de prueba especial se distribuyó entre 0,000 y 0,004, y los valores P se mostraron todos inferiores a 0,005, hubo una diferencia significativa en el rendimiento del grupo experimental antes y después del experimento. **Conclusión:** El entrenamiento experimental reveló un efecto positivo en el rendimiento específico del tenis y en la fuerza del núcleo abdominal del grupo experimental. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptorios: Entrenamiento de Fuerza; Tenis; Núcleo Abdominal.



INTRODUCTION

In tennis, core strength such as back, abdomen and hips are very important, They act as a center of rotation and are vital to transmit forces generated in the lower body up through the upper body and into the tennis stroke. In today's tennis competition, the increasingly fierce confrontation, the increase in the speed of offense and defense transition and the increase in the duration of the game, make tennis players must have more physical fitness in the game. Modern elite tennis players must participate in a series of international events every year, in order to obtain a higher ATP (WTA) ranking.¹ Tennis players frequently participate in large-scale competitions, on the one hand, players must have a more stable and reliable style of play in order to achieve more good results, because the bottom line style has more stable and reliable advantages than other online style styles, it has gradually become the mainstream style of tennis today; On the other hand, athletes must maintain adequate physical fitness throughout the season.² Weakness or limitations of core strength can reduce force and power transfer and thus affecting the performance of tennis players

Afandi M pointed out in "Mechanical Analysis of Tennis Serious Serve" by analyzing the impact of APS on Roddick's serving technique, a world famous tennis player, Roddick is known for his strong serve, in addition to his outstanding serving skills, the mechanics of his serve are also very distinctive, in the early stage of serving, the torsion of the body is extremely large, and the latissimus dorsi, rectus abdominis and external oblique muscles are fully stretched, so as to pull the body into a reverse arch, and release the potential energy formed by the body in the shortest time and convert it into the power of hitting the ball.³ Rar A mentioned in the core strength training research of competitive athletes: Core strength training is an indispensable factor in athletes' physical training, it is one of the important prerequisites to improve the sports quality of athletes.⁴ For athletes, the main function of core strength training is to stabilize the spine and pelvis of athletes, maintain correct body posture, improve body control and balance, improve energy output from core to limbs and other muscle groups during exercise, prevent Injury in action and recovery after injury, thereby contributing to the improvement of sports performance.⁵ In the training, the coaches should carry out specific practice according to different special requirements and the individual characteristics of the athletes, combined with the training methods and methods of various sports abilities.⁶

The training methods in this study included Dynamic exercises Bench sit-up, V-up, Hip-crossover, Bicycle crunch, Pelvic Tilt and static exercises Front Plank, side Plank, Flying Squirrel, Bird Dog, Static and dynamic cross exercises, 4 times a week, 30~40 minutes every time, each Dynamic exercise repeat 15 times and each static exercise is 30 seconds, repeat 3-5 sets, the rest between circuits would be 90 seconds, the rest between sets would be 2~3 minutes.

At present, the research is only at the qualitative stage, and there is no quantitative scientific empirical research, the author discovered exactly this problem, targeted selection of some young tennis players carried out a two-month experimental study, aiming to find out the exact index of the improvement of the stability of the core area muscle group to the improvement of tennis skills, and then give the mathematical relationship between the two.⁷

METHOD

Research object

In order to ensure the accuracy of the experiment, the author specially selected tennis players (age $13 \leq \text{Age} \leq 17$) from Hangzhou XiangJiang Tennis Club, a total of 12 young tennis players as participants in the experimental study. The experiment strictly adopts the standard mode of international sports experiments, that is, there are 6 subjects, 6 subjects

in the experimental comparison group (control group). All these athletes were carefully selected before testing, the contents of these selections include: Age, length of time engaged in tennis, basic physical conditions (height, weight, arm span, etc.), using statistical methods to conduct scientific statistics, and obtained the test P value of these 12 athletes in the above aspects > 0.05 , it shows that there is no significant difference in the above aspects, which means that the 12 players participating in the experiment have strong homogeneous characteristics, it laid an objective foundation for the comparison of the following experimental results. In addition, the experiment also conducted an investigation on the disease history of 12 team members, in order to ensure that the final test results are more authentic and effective. The details are shown in Table 1.

Research methods

Experimental method

The experimental method of this study is based on the advice of experts and scholars, the general experimental method of the current international sports experimental test is adopted. To this end, the author selected 12 male tennis players as the team members for this research experiment. The 12 team members were tested by a series of rigorous sports science experiments, after meeting the requirements of the mean value of the experimental base, the team members were divided into two groups, namely the experimental group with a total of 6 athletes, the control group (experimental comparison group) with a total of 6 players.⁸ The experimental period was 8 weeks. Through the designed nine independent variable actions, and through the continuous comparison between the experimental group and the control group after the experiment, the difference of the dependent variable is obtained. The experimental group adopts the 9 kinds of core strength Circuit training methods, that is a good method used to train muscular endurance, while the control group adopts the traditional strength training method, including push-up, rope skipping, Lateral Squat, forward lunge and the control group is the experimental reference standard.

Mathematical Statistics

The experimental group, the control group and the control group were subjected to corresponding experimental training, after two months, the three groups of athletes were tested accordingly, and the data obtained from the test were recorded, and use OFFICE EXCEL for data entry and establish a database, and then use the statistical software SPSS20.0 for statistical analysis of the data.⁹

Ethical Compliance

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Zhejiang University of Technology following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

RESULTS

Comparative analysis of the special sports ability and core strength of the control group before and after the experiment

After two months of tennis training, the tennis-specific ability performance and core stability of the control group were tested again, and the test scores after the experiment were statistically compared

Table 1. Statistical table of general conditions of subjects.

	N	Age	Years of training (years)	Height (M)	Weight (KG)	BMI (KG/M ²)
Overall	12	15.0±3.8	6.9±1.4	1.75±5.9	70.5±6.8	20.4±1.5
Test group	6	15.0±3.6	6.8±1.7	1.74±0.05	72.4±5.8	19.7±1.4
Control group	6	15.1±2.9	7.0±1.7	1.75±0.02	73.2±5.5	21.2±1.3

with those before the experiment, it is concluded that the statistical P value of special ability is distributed between 0.082 and 0.812, and the P values are all greater than 0.05, indicating that there is no significant difference between the two, the P value of the core stability statistical analysis is between 0.088 and 0.597, and the P values are all greater than 0.05, it can be concluded that, after two months of training, neither tennis-specific training nor core strength changed in the control group.

The author adopts the mode of group experiment + sub-period experiment, that is, the subjects are divided into two groups, and the experimental time is divided into two periods before and after, in this way, subjective and objective interference is avoided to the greatest extent, and at the same time, the value of experimental training itself is most truly reflected. From Table 2. and Table 3, it can be seen that after two months of experimental training, the special training and core strength of the control group did not change significantly.

Comparison of tennis special ability and core stability before and after the experiment in the experimental group

After 8 weeks of experimental training, the statistical analysis of the test results before and after the experimental group found that, the P values of the experimental group in the tennis special test were distributed between 0.01 and 0.04, and the P values were all less than 0.05, indicating that after 8 weeks of experimental training, there were significant differences in the special scores of the experimental group before and after the experiment. In the same way, the analysis of the core strength of the experimental group also concluded that, there were significant differences before and after the experiment. (Figure 1)

Bench sit-up, V-up, Hip-crossover, Bicycle crunch, Pelvic Tilt and static exercises side plank, Front Plank, Flying Squirrel, Bird Dog. (Table 4 and 5)

DISCUSSION

Core strength training involves the muscles of the waist, abdomen, back and hips, and this part of the muscle training is different from the muscle strength training of other parts of the body, it can only be completed by the control involving a variety of nerves, ligaments and muscle tissues, and the strength training of the core area also needs to be completed in multiple dimensions and at multiple levels, so the experimental training is arranged Static and dynamic training interleaved, the main purpose of static training is to develop strength, stability and balance of core muscles, when stability and balance are perfected, combined with dynamic training that incorporates the characteristics of tennis, it aims to improve the continuous ability of muscle contraction and release in different core regions, and maximize the functional ability of the body during exercise.¹⁰

Table 2. The comparison table of tennis-specific sports ability before and after the experiment in the control group.

	Before experiment	After the experiment	P
V-shaped move	26.5±0.9	26.8±1.0	0.16>0.05
Half "meter" word move	18.5±0.8	18.6±0.7	0.46>0.05
30s 15kg clean and jerk	19.9±9.5	28.3±7.9	0.07>0.05
30s Incline Plank Crunches	21.3±3.5	21.2±3.1	0.81>0.05
Double shake	35.6±8.7	39.1±10.9	0.08>0.05

Table 3. Comparison of core stability scores before and after the control group experiment.

	Before experiment	After the experiment	P
Lumbar flexion test	97.7±13.2	98.7±13.2	0.26>0.05
Waist Stretch Test	71.4±21.0	72.5±21.0	0.36>0.05
Right Bridge Test	22.1±4.7	23.2±4.7	0.60>0.05
Left bridge test	23.3±5.0	24.4±5.1	0.09>0.05

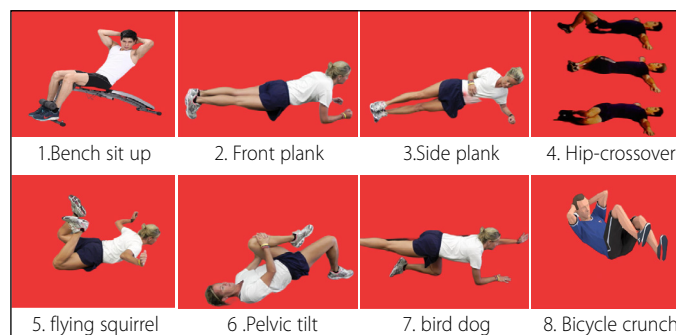


Figure 1. Motion action diagram.

Table 4. The methods of training of the experimental group.

The methods	Sets	Reps	Action required
Bench sit-up	1	15	Rapid coherence and coordination
Front plank	1	30 sec	body remains in a straight line
V-up	1	15	Hands touch feet, rapid
Left Side plank	1	15 sec	Body a straight line
Right side plank	1	15 sec	Body remains in a straight line
Hip-crossover	1	10	With kneels slightly bent, raise and lower legs slowly
Flying squirrel	1	30 sec	Torso and thighs held off the floor higher
Pelvic tilt	1	15	Up quickly and down slowly
Bird dog	1	30 sec	Body maintaining pelvic neutral
Bicycle crunch	1	30 sec	Raise upper body off the ground

3 sets , rest 2-3 minutes between sets

Table 5. Comparison of the results of the tennis special ability test before and after the experiment in the experimental group.

	Before experiment	After the experiment	P
V-shaped move	25.7±1.0	28.9±1.1	0.04
Half "meter" word move	19.3±0.7	16.6±0.6	0.03
30s 15kg clean and jerk	19.6±8.9	28.7±7.9	0.04
30s Incline Plank Crunches	18.1±2.8	27.6±3.4	0.01
Double shake	32.4±8.9	42.6±10.6	0.02

CONCLUSION

It can be concluded that the experimental training has a positive effect on the tennis specific performance and core strength of the experimental group. This study shew all participants improve their core strength, it would help to improve tennis player's sports level. Add core strength training content to tennis daily physical training, because core strength training has the characteristics of short time and flexible arrangement, it can be arranged in the preparation link before training, or in the finishing link after training, and continuously improve the tennis competition ability through the transfer training theory.

The author declare no potential conflict of interest related to this article

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