

INFLUENCE OF BIMANUAL GRIPPING ON BALANCE AND MOTOR COORDINATION IN TENNIS PLAYERS

INFLUÊNCIA DA EMPUNHADURA BIMANUAL SOBRE O EQUILÍBRIO E A COORDENAÇÃO MOTORA EM TENISTAS

INFLUENCIA DEL AGARRE BIMANUAL EN EL EQUILIBRIO Y LA COORDINACIÓN MOTORA DE LOS TENISTAS



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ABSTRACT

Introduction: There is empirical evidence that training with bimanual grip can improve tennis's technical and tactical level. However, this practice lacks a scientific study supporting its fundamentals and methodological arguments for effective training. **Objective:** Investigate the influences of two-handed grip training on balance and motor coordination in tennis players. **Methods:** The study was conducted by literature data collection, experimental testing, and mathematical statistics. A bimanual grip training protocol was designed and tested on volunteer athletes. Biomarkers were collected, discussed, and analyzed inter- and intra-group statistically. **Results:** After 5 weeks of basic training, there were significant differences in homeostatic control and physical agility between the experimental and control groups. After training, the dynamic balance ability of the experimental group athletes was significantly improved. **Conclusion:** The study results show that training, according to the proposed protocol, can benefit athletes' dynamic balance and motor coordination, improving motor coordination and balance in practical sports movements. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Physical Education and Training; Postural Balance; Psychomotor Performance; Tennis.

RESUMO

Introdução: Há evidências empíricas de que o treinamento com empunhadura bimanual pode melhorar o nível técnico e tático na prática esportiva do tênis. Porém, essa prática carece de um estudo científico embasando seus fundamentos e as suas argumentações metodológicas para treinos efetivos. **Objetivo:** Pesquisar sobre as influências do treinamento da empunhadura bimanual sobre o equilíbrio e a coordenação motora em tenistas. **Métodos:** O estudo foi conduzido por coleta de dados bibliográficos, teste experimental e estatísticas matemáticas. Um protocolo de treinamento em empunhadura bimanual foi elaborado e testado em atletas voluntários. Os biomarcadores foram coletados, discutidos e analisados inter e intra-grupo estatisticamente. **Resultados:** Após 5 semanas de treinamento básico, houveram diferenças significativas no controle homeostático e na agilidade física entre os grupos experimental e controle. Após o treinamento, a capacidade de equilíbrio dinâmico dos atletas do grupo experimental foi aprimorada significativamente. **Conclusão:** Os resultados do estudo mostram que o treinamento, segundo o protocolo proposto, pode beneficiar o equilíbrio dinâmico e a coordenação motora dos atletas, melhorando a coordenação motora e o equilíbrio em movimentos práticos do esporte. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Educação Física e Treinamento; Equilíbrio Postural; Desempenho Psicomotor; Tênis.

RESUMEN

Introducción: Existen evidencias empíricas de que el entrenamiento con mango bimanual puede mejorar el nivel técnico y táctico en la práctica deportiva del tenis. Sin embargo, esta práctica carece de un estudio científico basado en sus fundamentos y en sus argumentos metodológicos para que los entrenamientos sean eficaces. **Objetivo:** Investigar las influencias del entrenamiento del agarre bimanual sobre el equilibrio y la coordinación motora en tenistas. **Métodos:** El estudio se llevó a cabo mediante la recopilación de datos bibliográficos, la realización de pruebas experimentales y la estadística matemática. Se diseñó un protocolo de entrenamiento de agarre bimanual y se probó en atletas voluntarios. Los biomarcadores se recogieron, discutieron y se analizaron estadísticamente en inter e intragrupos. **Resultados:** Tras 5 semanas de entrenamiento básico, hubo diferencias significativas en el control homeostático y la agilidad física entre los grupos experimental y de control. Tras el entrenamiento, la capacidad de equilibrio dinámico de los atletas del grupo experimental mejoró significativamente. **Conclusión:** Los resultados del estudio muestran que el entrenamiento, según el protocolo propuesto, puede beneficiar el equilibrio dinámico y la coordinación motora de los atletas, mejorando la coordinación motora y el equilibrio en los movimientos deportivos prácticos. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptorios: Educación y Entrenamiento Físico; Equilíbrio Postural; Desempenho Psicomotor; Tenis.



INTRODUCTION

Dynamic balance and coordination are achieved by controlling the body's internal center of gravity, the ability to maintain movement stability and maintain supportive features. It is not only the key ability of the human body to prevent falls and perform functional tasks, but also the key to high-level athletes to keep their confrontational technical movements unchanged. For two-handed sword players, their athletic performance is not determined by a single quality such as physique or technique, but by a combination of multiple regulatory factors such as tennis training.¹ Physical fitness, technique, tactics and psychology have interactive effects on performance, and are moderated or mediated by multi-dimensional factors such as sports motivation, training environment, injuries and diseases. Research confirms that athletes in different sports at all stages of technical learning and motor skill development, the proficiency of its "neighborhood motor skills" is inversely proportional to the time required to master special skills, suggesting that there may be a good transfer effect between motor coordination and special skills acquisition.² Tennis is a sport that requires high agility and coordination, in competitive competitions, the situation is complex and changing rapidly, athletes are required to react quickly, make judgments, change body positions quickly, and require high body control and coordination. At the same time, adolescence is a critical period for developing balance and agility.³ A study by some scholars found that there is a relationship between tennis training and agility in non-athletic populations. The effects of tennis training on homeostasis and agility have not been studied, especially in young athletes. Therefore, the author takes two-handed sword players as the object of investigation, explore the effects of core training on balance and agility in young tennis players.⁴

METHOD

Documentation method

Thirty two-handed sword players were selected as subjects, including 15 boys and 15 girls, with an average age of 15.3 years. All subjects had more than one year of tennis training experience, and all subjects were screened, in order to ensure that there is no musculoskeletal, cardiac, or neurological disease, and all subjects volunteered to participate in this experiment. Athletes were randomly divided into experimental group (EX, n = 15) and control group (DF, n = 15) to train for 5 weeks, train tennis 3 times a week. Before the formal experiment, all athletes were given a week of pre-training to understand the training content and process in the experiment, after the adaptive pre-experiment, they took a week off and started the formal experiment. Before each training, the athletes performed a 15-minute warm-up exercise, the experimental training and the control training were both 30 minutes, and the basketball special training was carried out after a 15-minute rest, including technical training (20 minutes), half-court training (20 minutes) and full attack and full defense game (20 minutes). The rope skipping training requirements for the experimental group are as follows: The frequency of tennis hitting was maintained at

120-135 r/min, including singles (10 min), reverse singles (10 min), and doubles (10 min). The control group underwent jogging training with corresponding time and intensity, both the experimental group and the control group were equipped with a commissioner to conduct field inspections.⁵ Table 1 shows the training content and training effect.

Experimental test method

Experimental studies have found that the T-test is used to assess sensitivity, and many researchers believe that the T-test is very reliable for measuring sensitivity. When the athlete hears the start signal, they will run from the mark point ① run to the middle mark point ② (10 meters apart). Then, slide sideways to the mark point ③ and touch the mark point with your hand (5 meters apart). Then, quickly change direction and do a side slide to the mark point ④ and touch it with your hand (a distance of 10). Finally, turn back and slide to the mark point ②, touch it with your hand, quickly turn back and run to the mark point ①, and use the stopwatch to record the total time, accurate to 0.01s. Subjects were asked to run as fast as they could, with a 2-min rest period between each trial to avoid fatigue.⁶ There was no significant difference in the overall dynamic balance ability between the control group and the experimental group before the experiment, because the left leg and the right hand cooperated with each other, which is the main force-bearing leg of the human body, and its dynamic balance ability is relatively high, which is in line with the actual situation. The dynamic balance and coordination of the front left leg of the experimental group and the control group had certain differences ($p < 0.05$, Power = 0.57), which were natural differences within the normal error range and did not affect the experimental content. The test results of the experimental group and the control group before and after the experiment are shown in Table 2.

Mathematical Statistics

SPSS 23.0 was used for statistical analysis of all data. The pre- and post-test values of the dependent variable were tested with the Shapiro Wilk test, determine whether it follows a normal distribution.⁷ After 5 weeks of aerobic exercise in the experimental group, there was no significant difference in the dynamic balance ability of the left and right legs of the athletes between the experimental group and the control group before the experiment, Figure 1 shows the change curve of the balance ability after the test. After tennis training, the dynamic balance and coordination of the two-handed sword players in the experimental group were significantly improved, and the difference in balance stability between the legs was reduced. After jogging training, there was no significant change in the dynamic balance ability of the athletes in the control group, and the dynamic balance ability of the athletes in the experimental group was significantly stronger than that of the jogging training athletes after training.⁸ Tennis training can significantly reduce the athlete's landing contact time and dynamic air height, and has the effect of super isometric training with the improvement of the athlete's bounce index, five weeks of rope skipping training can effectively improve the dynamic balance and coordination ability of two-handed sword players.⁹

Table 1. Training content and training effect.

	training content		training effect
control group	Running (10 min)	Jump rope (10 min)	66 points
test group	(Reverse) Singles (10 min)	Doubles (10 min)	85 points

Table 2. Analysis of the test results before and after the experiment and the control group.

	test group	control group	P
T-test	10.81±0.44	10.76±0.55	0.63
SEBT test	69.42±0.58	6.93±5.46	0.72

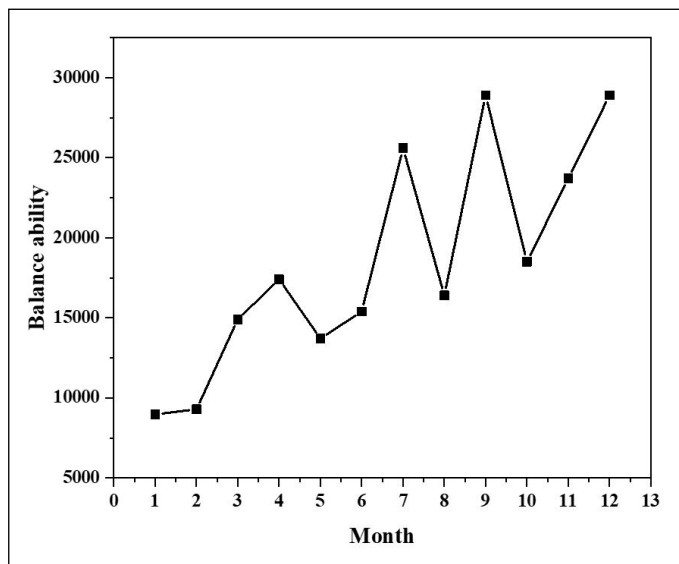


Figure 1. Change curve of balance ability after test.

Ethical Compliance

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

RESULTS AND ANALYSIS

Dynamic balance and coordination are the ability to control the position of the body's center of gravity and maintain stable support, which play an important role in preventing falls and performing functional tasks, essential for two-handed swordsmen performing complex motor tasks, at the same time, it is closely related to the prevention of sports injuries. The normal operation of the human body's balance mechanism depends on the body's sensory control system, and mainly relies on proprioceptive, visual and vestibular processing in the cognitive process of information input.¹⁰ Tennis training abilities include agility, quickness, balance, speed and flexibility. Core muscles play an important role in postural control and multiplanar movement in two-handed swordsmen. Postural control is a necessary condition for the dynamic movement of tennis players in multiple plane directions. The test better mimics the multi-directional movement of two-handed swordsmen on the court. After a five-week core training program, the athletes showed significant differences in agility and dynamic balance. After 5 weeks of jogging training, the results showed that although the YBT of the athlete's dynamic balance ability of both legs improved from 124.33 ± 13.90 before the test to 124.99 ± 12.16 after jogging training, however, from a statistical point of view, the YBT of the legs in the post-training group did not significantly improve, and the jogging training only strengthened the balance stability of the athletes. Table 3 is the comparative analysis after the experiment. At the same time, the YBT of the left and right legs of the training group did not

Table 3. Comparative analysis after the experiment.

	Test group		Control group	
	Left leg	Right leg	Left leg	Right leg
Front	53.27±5.81	53.08±7.19	5.27±5.77	5.27±5.77
Posteromedial	42.31±2.76	42.08±2.07	4.11±2.89	4.11±2.89
Posterolateral	39.19±1.79	36.99±1.98	38.97±1.54	38.97±1.54

increase significantly, specifically, anterior left leg only ($p < 0.05$, $\eta^2 = 0.371$), anterior right leg ($p < 0.05$, $\eta^2 = 0.324$), posteromedial ($p < 0.01$, $\eta^2 = 0.008$) there has been a relatively obvious improvement, but it has promoted the overall movement balance ability of athletes.

DISCUSSION

After tennis training, the changes in balance and agility of the athletes after training were more obvious. This is consistent with previous studies, tennis training does improve an athlete's balance and coordination. The research results of the author and others can only confirm that training can improve dynamic balance ability and motor coordination, and dynamic balance ability and motor coordination are the important basis for the development of special technology. Therefore, there is currently a lack of direct evidence that RS training improves soccer-specific skills. Therefore, future research needs to clarify the following important aspects: 1) Whether there is a causal relationship between the improvement of the two qualities of dynamic balance ability and motor coordination; 2) These two types of qualities, for the development of special skills for young football players, what degree of promotion exists; 3) Whether RS training helps to improve the special skills of young football players, and the explanation of physiological and biomechanical mechanisms.

CONCLUSION

The results of this study showed that, both the dynamic balance and agility of the two-handed swordsmen who have gone through the tennis training program have been improved. Therefore, compared with conventional training, core training has a better effect on improving the balance and agility of young athletes, it is suggested that core training can be incorporated into the daily training program of tennis players to improve the dynamic balance and coordination of tennis players, and ultimately improve sports performance and win the game. With the continuous evolution of the world sports trend, the trend of emphasizing the comprehensiveness and balance of athletes' abilities is constantly emerging, and coordinating multiple sports tasks has become the main threshold for athletes to become elite athletes.

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