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Effect of motor imagery training on tennis service performance in young tennis athletes

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Abstract

The objective of the study was to analyse the effect of motor imagery training on tennis service performance among tennis athletes. Participants were twenty-eight young male tennis players, randomly divided into two groups: imagery training (ITG, n = 14) and control group (CG, n = 14). It was a controlled and randomized experimental investigation, lasting eight weeks. The CG watched videos about the history of the Olympics, while ITG did motor imagery training. The tennis service performance was obtained by the product between accuracy and stroke velocity [accuracy x mean velocity of all strokes (km/h)]. The effect of group vs time interaction ($p < .01$) was identified for all performance indicators [accuracy, running speed and performance (precision x speed)], with improvement only in ITG ($p = 01$). It concluded that motor imagery training would be considered an effective strategy to enhance the tennis service performance among male tennis players.

Keywords: tennis, athletes, sport, sports psychology

Tennis is played with one (recreational and lower leagues), better of 3 or 5 sets (López-Samanes, Pallarés, Pérez-López, Mora-Rodríguez and Ortega, 2018). In addition, tennis matches may take place on grass, clay, or hard court (Martínez-Gallego, Guzmán, Crespo, Ramón-Llin and Vučković, 2017). Also, on average, a tennis match lasts two hours (Fernandez-Fernandez, Mendez-Villanueva and Pluim, 2006). According to the main characteristics of the game, tennis players perform intermittent muscle actions, alternating high intensity and active recovery moments during the match (Carvalho, Araújo, González and Iglesias, 2011; Fernandez-Fernandez et al., 2006; Lópes-Samanes et al., 2018). Therefore, players need enhanced technical (e.g., forehand, backhand, lob, smash and service) and physical skills (e.g., aerobic capacity, sprint repeat capacity, agility and muscle power), which are required to perform well in tennis (Brody, 2003; Pereira et al., 2016).

Thereby, tennis service depends on two components: accuracy and stroke velocity (Hayes, Spits, Watts and Kelly, 2018). Accuracy refers to the precision of the location where the ball hits the opponent court, whereas stroke velocity refers to the ratio between the distance traveled by the ball and time (Le Mansec, Pageaux, Nordez, Dorel and Jubeau, 2017). According to Hayes et al. (2018), tennis service is an essential foundation to obtain a good performance in a match, since a service well executed will either impair opponent reception or provide a direct score. Moreover, a scientific finding pointed out that ~25% of scores in tennis are originated from the service (Whiteside and Reid, 2017).

In fact, physical (e.g., muscular strength/power) and technical training (e.g., a technique for holding the racket) may enhance tennis service performance (Hayes et al., 2018). However, in the case of athletes, a coach can adopt any other type of intervention that can enhance tennis service performance. An alternative that has been widely used by sports psychologists and coaches to improve athletes physical' performance is motor imagery training (Battaglia et al., 2014; Guillot, Desliens, Rouyer and Rogowski, 2013; Guillot et al., 2015; Slimani, Chaabene, Miarka and Chamari, 2016).

The psychoneuromuscular theory (Jeannerod, 2001) states that the motor imagery accesses the motor cortex and generates neuromuscular activation like performing a motor task. Overall, the imagery training might assist the process of motor expertise. Interestingly, motor expertise leads to the activity-dependent neural reorganizations of the networks in the brain, controlling both real and imaginary performances. The imagery literature shows that brain activations during imagery training reflect lifelong brain changes caused by successive online and offline neural reorganizations elicited by intense amounts of practice (Di Rienzo et al., 2016).

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The motor imagery may be used followed by mental images from sensory processes stored in memory that can be reached without external stimuli (Curtin, Munroe-Chandler and Loughead, 2016). Motor imagery is experienced in first or third-person perspectives (Munroe-Chandler and Guerrero, 2017). According to the third-person perspective, the athlete might imagine the motor action from the position of a virtual onlooker, watching himself performing, whereas, with the first-person perspective, the athlete imagines himself performing the action. The first-person perspective in motor imagery is also named kinesthetic motor imagery, while the third-person perspective is called visual motor imagery (Ridderinkhof and Brass, 2015). Note that the first-person perspective might entail both kinesthetic and visual motor imagery, but also there is no proper one-to-one mapping of first/ third-person perspective to kinesthetic/visual motor imagery (Ridderinkhof and Brass, 2015).

The chosen perspective depends on a variety of factors, including the outcome focus. Motor imagery training deals with the systematization of motor imagery sessions, which advocate cognitive functions (e.g., motor skills), operating on a general (e.g., game situation) or specific (e.g., service tennis) level (Curtin et al., 2016).

Studies have demonstrated positive acute effects of motor imagery training on free- throws (Kanthack, Bigliassi, Vieira and Altimari, 2014), tennis service (Guillot et al., 2015), and strength in athletes (Di Rienzo et al., 2015). Thereby, it is recommendable to include motor imagery training chronically in athletes training program. Scientific investigations revealed an increase in muscle strength/ power in athletes that underwent the motor imagery training program (Guillot, 2010; Slimani et al., 2016; Slimani and Cheor, 2016). To the best of the authors' knowledge and considering tennis specifically, only two studies analyzed the effect of motor imagery training (Guillot et al., 2015; Guillot et al., 2013). It is important to highlight that the investigation by Guillot et al. (2013) did not include a control group, in addition to presenting a reduced number of participants (tennis players of both sexes) (12), which makes it difficult to generalize the findings. Also, the study by Guillot et al. (2015) showed an acute experimental design, which also limits findings inference, considering that it is not possible to sustain the fact that improvements will continue occurring long-term. As such, it is important to conduct research that seeks to analyze the chronic effect of motor imagery training (e.g., eight weeks), by adopting a randomized controlled trial, which includes control group in tennis athletes. Therefore, the present research tries to fill this knowledge gap (chronic effect adopting a randomized and controlled trial with tennis athletes).

From a practical point of view, this type of research may help tennis coaches choose whether to insert motor imagery training into the athletes practice routine. Therefore, the objective of the study is to analyze the effect of motor imagery training on tennis service performance among young tennis athletes. The hypothesis put forth is that motor imagery training program enhances tennis service performance (accuracy and stroke velocity).

Materials and Methods

Ethical aspects

Institutional Review Board at the Federal University of Pernambuco in compliance with the Brazilian National Research Ethics System Guidelines approved the procedures of this study. Written informed consent was obtained from each participant before participation.

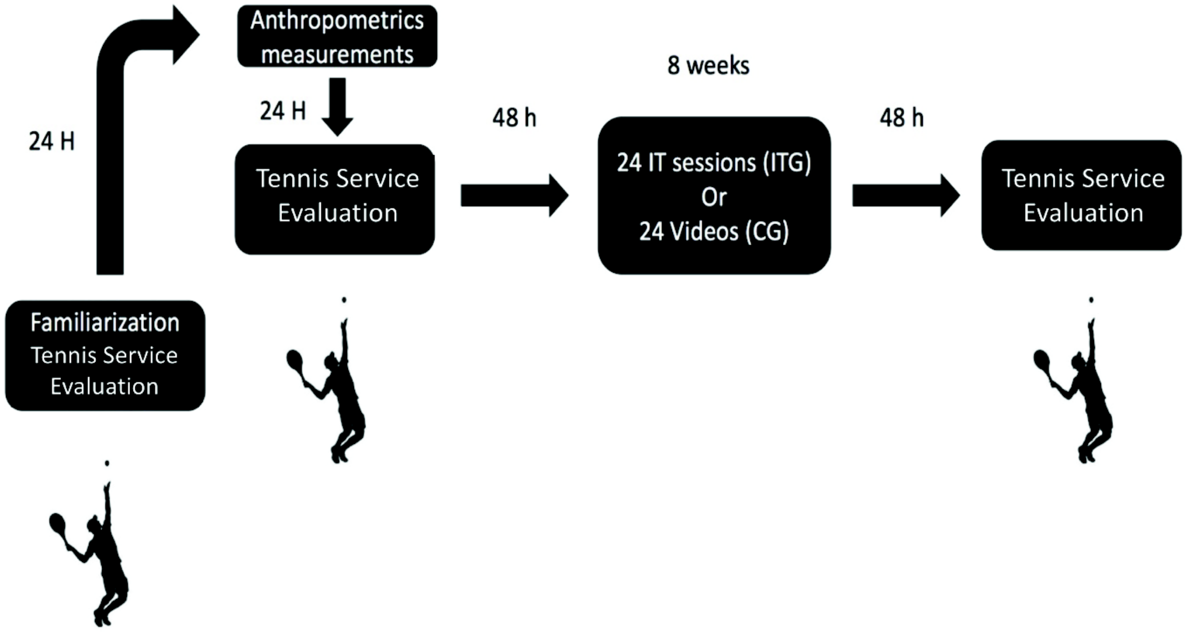
Participants

The sample size needed to conduct the research was analyzed in the G*Power 3.1 software. Power of 0.80, α = 0.05 and effect size of 0.50 were adopted. The sample size of twenty-four subjects was necessary to conduct the experiment.

Participants were twenty-eight young male tennis players aged 15 to 16 years [Imagery Training Group (ITG): 15.37 ±0.22 years; Control Group (CG): 15.45 ±0.33 years], selected in a non-probabilistic manner. Participants were randomly divided into two groups (Figure 1): ITG (n = 14) and CG (n = 14). For randomization, the survey coordinator used a manually generated numbers to determine the allocation of athletes in each group. The randomized distribution between ITG and CG was stratified by a website (www.randomizer.org). After randomization, it was not necessary to counterbalance between the groups. Demographic, anthropometric data, and score in the Movement Imagery Questionnaire (MIQ-3) of the two groups (ITG and CG) are presented in Table 2.

On average, the tennis players trained two hours a day, and typically four times a week. To be included in the research, given the inclusion criteria of other investigations with racket sport athletes (Guillot et al., 2015, Wang et al., 2014), the participants should: a) be a tennis athlete for at least two years; b) systematically train tennis for at least eight hours per week; and c) enrolled in the State Tennis Championship.

Figure 1. Experimental design



Note. IT = imagery training group; CG = control group

Experimental design

It was a controlled and randomized experimental investigation, lasting eight weeks, developed with young male tennis athletes. Both groups (ITG and CG) completed the same physical/technical training plan over the course of eight weeks (Table 1). The training plan included four weeks of training intensification (competitive period) and four weeks of training volume reduction (tapering).

The CG watched videos about the history of the Olympics, while ITG performed motor imagery training. Three weekly sessions of motor imagery training were performed, interspersed within a 48-hour period, totaling twenty-four sessions over the course of eight weeks. The sessions occurred in thirty-minute intervals between the end of the physical/ technical training session and the beginning of the motor imagery training session. All motor imagery training sessions lasted approximately ten minutes in a quiet environment (close to the tennis court) with the athletes wearing the clothes that they usually compete in (Fortes, Lira, Lima, Almeida and Ferreira, 2016; Fortes et al., 2018). It is important to note that prior to each session of motor imagery training, videos of tennis players that succeed at service were used to facilitate the imaginative capacity of the athletes in the ITG, agreeing with Battaglia et al. (2014) in another investigation of motor imagery training. The use of videos is essential to improving motor imagery ability because it facilitates observation in the context of sport, which may be explained by the brain stimulation as sensory- perceptive factors are accessible through subconscious management. This study utilized Guillot's et al. (2015) recommendations to elaborate the protocol of motor imagery training. Therefore, this study adopted the cognitive-specific type of imagery, which requested the athletes to imagine themselves performing tennis service. This method revealed the following information (Fortes et al., 2016; Fortes et al., 2018): a) to imagine a situation in the first person; b) to imagine the task at speeds close to reality, adopting approximately ten second intervals between each imagination of the service; c) to imagine positive situations during a competition; d) to replicate emotions (anxiety and mood) similar to those experienced during competitions. At every ten screens of tennis service imagination, the participants were asked to provide information about the technique adopted and the magnitude of the perceived emotions (anxiety and mood) during the imagination. Following, the researcher in charge of conducting the motor imagery training protocol provided feedback to the participants aiming technique enhancement and emotion control during the next tennis service imagery screening. A timer (Kikos CR60, São Paulo, Brazil) was provided to each athlete to control the duration of the mental simulation of the ten tennis service trial in each session. All the participants in the research had previous experience with motor imagery training sessions of the cognitive-specific type, even though the protocol of the present study was partially different from the motor imagery training program commonly performed with those athletes.

Although the Consolidated Standards of Reporting Trials (CONSORT) recommends performing a blind or double-blind experimental study, the present study only adopted this procedure for data analysis because the lead researcher of the statistical analysis had no knowledge about which group was experimental or control. In addition, the experiment adopted a placebo intervention, which reduces the possibility of bias in the experimental intervention. It is also worth mentioning that two researchers, who were considered experts in motor imagery training (five years of experience in motor imagery training), were responsible for conducting the interventions in the ITG and CG. The researchers were counterbalanced in the twenty-four sessions of motor imagery training for the ITG or videos for the CG, with the premise of avoiding any kind of bias between the groups.

A tennis service performance familiarization session was held. The tennis service performance (accuracy and stroke velocity) was measured forty-eight hours before and after eight weeks of intervention, as shown in Figure 2.

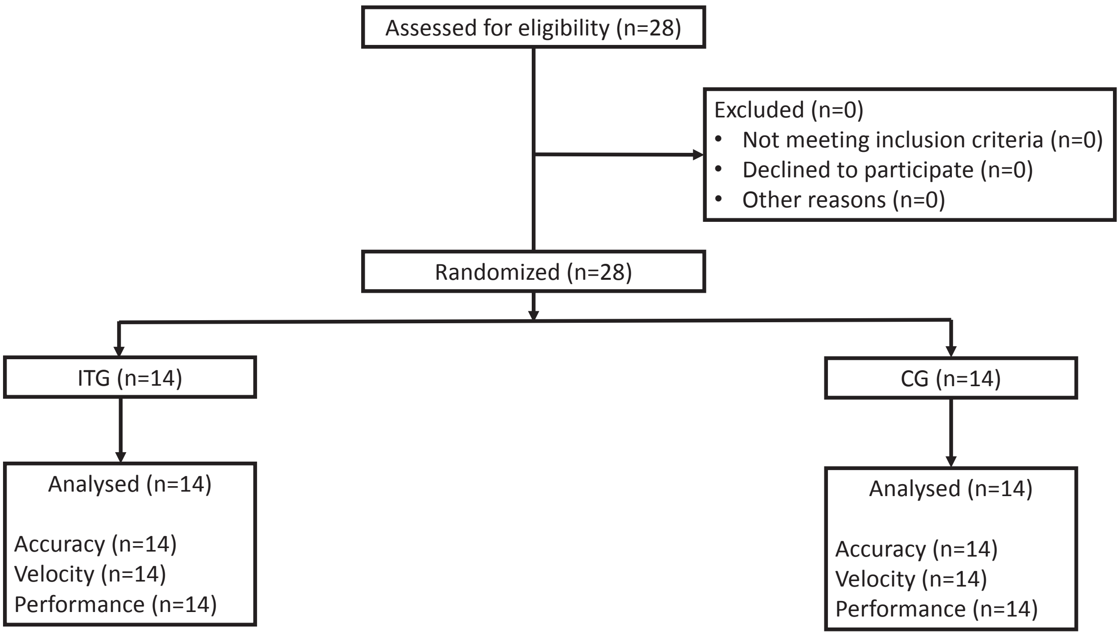
Table 1

Training periodization (8 weeks)

Mesocycle	Preparatory				Tapering			
Microcycle	1	2	3	4	5	6	7	8
Volume (%)								
100								
90								
80								
70								
60								
50								
40								
30								
20								
Intensity	80-100%				90-100%			

Note. Colored area (gray): indicates the % of volume adopted each week (microcycle) during 8 weeks; Intensity: represent the % of maximum heart rate.

Figure 2. Sample distribuition

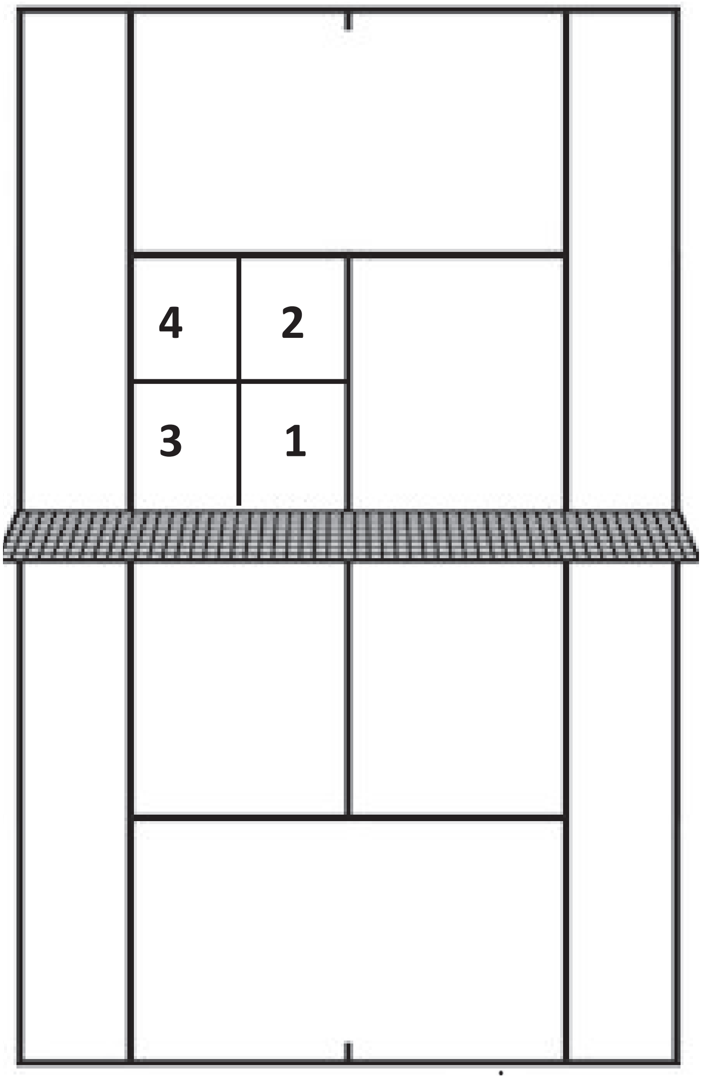


Note. IT = imagery training group; CG = control group

Measures

Tennis Service Performance. The tennis service performance evaluation closely followed the procedure described by Guillot et al. (2015). Briefly, players performed one set of ten tennis services. They were instructed to hit as fast as possible toward a target, while focusing on achieving a winning shot. A radar gun (Stalker Pro II, Stalker Radar, Plano, TX, USA) was located behind the player to record ball velocity. A target with four areas was drawn on the court to assess service accuracy, as shown in Figure 3. The score on the tennis service test (ten attempts) was added based on where the ball hit (Figure 3). Another location of the ball bounce resulted in zero points. The accuracy was/is the sum of all points. A higher score corresponded to greater accuracy, while stroke velocity corresponded to the mean velocity of all strokes. The tennis service performance was/is the product between accuracy and stroke velocity [accuracy x mean velocity of all strokes (km/h)]

Figure 3. Tennis Service Performance Test (court scores)



Movement Imagery Questionnaire (MIQ-3). MIQ-3 was used to evaluate the imaginative capacity of the athletes. The MIQ-3 (Williams et al., 2012) is composed of twelve points Likert items, which assess the individual ability to mentally visualize movements. The twelve points Likert items are divided into three factors with four items each: internal mental visualization, external mental visualization, and kinesthetic mental visualization. The MIQ-3 was validated for the Portuguese language by Mendes et al. (2016), demonstrating satisfactory psychometric properties. The present study had an internal consistency of 0.76 for MIQ-3.

Biology maturity. The assessment of biological maturation used somatic maturation as a standard of growth.

Thus, body mass, height and trunk-cephalic height were measured. The length of the legs is the difference between height and trunk-cephalic height. These measures along with chronological age were used in an equation established by Mirwald, Baxter-Jones, Bailey and Beunen (2002), who estimated the age of peak growth velocity in height. Due to the scientific findings of the influence of biological maturation on the technical and physical performance of athletes (Matta, Figueiredo, Garcia and Seabra, 2014), it was decided to control (statistical techniques) the age of peak growth velocity in height in the present research.

Anthropometry. Body density was determined using the thickness technique of the skinfolds, using a compass of the brand Lange© (USA), using triceps and subscapular skinfolds, adopting the protocol of Slaughter et al. (1988), which takes ethnicity (white or black) and the maturational stage according to chronological age (pubertal age 12 to 14 years and post- pubertal age 15-17 years). In this sense, the ethnicity was determined through self- assessment. The International Society for Advancement for Kinanthropometry (2013) was used to measure the skinfolds. The body fat percentage (%BF) was determined using the Siri equation (1956).

Data analysis

The Shapiro Wilk test was conducted to evaluate data distribution. Due to the non- parametric violation in both groups (ITG and CG), the study opted for the use of parametric techniques. The mean and standard deviation were used to describe all variables (tennis service performance, %BF, training regimen, age and MIQ-3). Repeated measures multivariate analysis of covariance (MANOVA) was conducted to evaluate the interaction between group (ITG vs. CG) vs. time (pre- vs post-experiment) for tennis service performance indicators. The age of peak growth velocity in height was statistically controlled (covariate). This statistical technique (covariate) was adopted to remove the effect of biological maturity on tennis service performance (accuracy and stroke velocity). In addition, we used the effect size, adopting the eta-squared (h2), to point to the magnitude of the statistical differences. The following criteria were adopted, according to Rhea (2004): h2 <0.2 = trivial; 0.2 ≤ h2< 0.8 = low effect size, 0.8 ≤ h2< 1.5 = moderate effect size and, h2 ≥ 1.5 = large effect size. All data were processed in SPSS 21.0 software, adopting a significance level of 5%.

Results

Baseline descriptive data (%BF, age, weekly practice routine and MIQ-3) is in Table 2. It should be noted that no statistical differences were identified for age ($F(2, 26) = 2.43$, $p = 0.22$), %BF ($F(2, 26) = 2.86$, $p = 0.28$), weekly practice routine ($F(2, 28) = 1.05$, $p = 0.40$), biology maturity ($F(2, 28) = 1.76$, $p = 0.38$) and MIQ-3 score ($F(2, 28) = 2.99$, $p = 0.19$) between ITG and CG before beginning the intervention, indicating groups homogeneity.

Table 2
Values (mean and standard deviation) of descriptive research variables

Variables	ITG	CG	p
	Mean (SD)	Mean (SD)	
%BF	18.2 (3.8)	17.7 (3.2)	.28
Age (years)	15.4 (0.2)	15.5 (0.3)	.32
Biology maturity (PG)	1.8 (0.4)	1.6 (0.5)	.38
Regimen training (weekly hours)	8.3 (0.1)	8.3 (0.1)	.40
MIQ-3	48.1 (7.0)	50.9 (6.7)	.19

Note. SD = standard deviation; %BF = body fat percentage; MIQ-3 = Movement Imagery Questionnaire -3; ITG = imagery training group; CG = control group; PG = peak of growth.

No statistical differences were identified for tennis service accuracy ($F(2, 28) = 3.75$, $p = .21$), stroke velocity ($F(2, 28) = 3.09$, $p = 0.32$), and tennis service performance ($F(2, 28) = 2.04$, $p = 0.34$) in baseline (Table 3). Table 3 presents the results of comparisons between groups (ITG vs CG). It identified group vs time interaction effect ($p < 0.01$) for all performance indicators [accuracy, stroke velocity and performance (accuracy x stroke velocity)], with improvement only in ITG ($p = 0.01$). It found moderate effect size for accuracy (ES = 0.8), stroke velocity (ES = 0.7) and tennis service performance (ES = 0.8) for ITG.

Table 3
Mean and standard deviation of accuracy, stroke velocity and tennis service performance according to step (baseline and post) and group (ITG vs CG)

Variables	ITG (n = 14)	CG (n = 14)	Effect	F	p
Accuracy					
Baseline	25.6 ± 3.1	24.2 ± 3.8			.21
Post	28.7 ± 3.5*	24.3 ±3.6			
Δ%	9.0	1.2	GxT Interaction	43.2	0.01
ES	0.8	0.1			
Stroke Velocity (km/h)					
Baseline	117.2 ± 8.0	115.7 ± 9.4			.32
Post	125.6 ± 7.3*	118.1 ± 8.7			
Δ%	7.6	1.8	GxT Interaction	39.2	0.01
ES	0.7	0.2			
Tennis Service Performance					
Baseline	2,918.4 ± 102.1	2,887.8 ± 107.5			.34
Post	3,214.6 ± 113.9 *	2,903.6 ± 102.0			
Δ%	9.3	1.5	GxT Interaction	49.4	0.01
ES	0.8	0.1			

*Note. Values are presented as mean ± standard deviation; ITG = imagery training group; CG = control group; ES = effect size; GxT = group vs. time; *p < 0.05 vs. baseline.*

Discussion

The objective of this study was to analyze the effect of motor imagery training on tennis service performance among young male tennis athletes. The main findings revealed improvements in accuracy, stroke velocity and tennis service performance in ITG, supporting the investigation hypothesis.

The findings of this study demonstrated the improvement of tennis service performance in ITG, corroborating other studies that showed improvement in physical tasks performance due to motor imagery training (Battaglia et al., 2014; Guillot et al., 2013; Guillot et al., 2015). There was an observed improvement of 9.0, 7.6, and 9.3% for accuracy, stroke velocity, and tennis service performance, respectively, in ITG, whereas there was no statistically significant change identified for CG. It is important to highlight the moderate effect size found for accuracy, stroke velocity, and tennis service performance in ITG. Guillot et al. (2015) investigated the effect of motor imagery training on groundstroke performance in young tennis players and showed that ball speed and accuracy did not attenuate after a high intensity training session. Guillot et al. (2013) showed 4% improvement on service performance (assessed by accuracy and velocity) among twelve French tennis players after six weeks of motor imagery training program. In this sense, motor imagery training has been indicated as an intervention strategy, which entails positive effects on athletes' physical performance.

Researchers point out that mental image creation derived from motor imagery training might increase muscle electromyographic (EMG) activation during the motor imagery session (Wang et al., 2014) or posterior motor task to motor imagery training program (Di Rienzo et al., 2015; Fontani et al., 2007). Corroborating this hypothesis, Wang et al. (2014) assessed the effect of the motor imagery training among sixteen Chinese badminton athletes and revealed a greater EMG amplitude in the muscles of the hands in the motor imagery condition training with the racket. Besides, Di Rienzo et al. (2015) analyzed the effect of motor imagery training in athletes (tennis, volleyball, and handball) and revealed an increased EMG of the biceps brachii. Although in the present study the EMG was not evaluated, the findings indicated improvements in accuracy and stroke velocity. Therefore, these enhancements might attribute to an increase in the activity of neurons in several areas of the brain responsible for the execution of the motor command, which is thought to lead to an increase in performance and learning through repeated motor imagery. Ruffino, Papaxanthis and Lebon (2016) indicated some possible neurophysiological mechanisms that might explain the improvement in motor performance from motor imagery training since the motor improvements were associated with brain modulation. Thus, it seems that motor imagery training involves cortical reorganization, increasing the corticospinal excitability, mainly in the primary motor cortex. Specifically, at the cortical level, cortico-cerebellum and corticostriatal networks are activated in the learning phase. In addition to neural plasticity at the cortical level, the reinforcement of synapse conductivity and the decrease of pre-synaptic inhibition at the spinal level might also be part of neural modulation after motor imagery training. Changes in the neural control of muscles might underlie the effect of motor imagery training on muscle coordination or an increase in the activation levels of the target muscles (Slimani et al., 2016). Thereby, neural adaptations induced by motor imagery training may also provide improvements in muscle coordination, such as reductions in the activity of the antagonist muscles when exerting the agonist muscle (Slimani et al., 2016), which might explain the enhancement on tennis service accuracy in ITG.

Considering the strength production and muscular power, neurological mechanisms, most likely at the cortical level and physiological factors, play a main role (Slimani et al., 2016). Physiology research on strength training found that the increase in strength gains is mostly caused by neural adaptations (Schoenfeld, Ogborn and Krieger, 2016). In fact, Yao, Ranganathan, Allexandre, Siemionow and Yue (2013) suggested that neural factors, rather than changes at the muscular level, largely account for motor imagery training induced strength gains. Thereby, motor imagery training is reported to increase the performance of strength-based tasks for both distal and proximal muscles of the human upper and lower extremities (Fontani et al., 2007). Recently, Tod, Edwards, McGuigan and Lovell (2015) showed a significant effect of motor imagery on muscular strength. In this direction, the enhancement in stroke velocity, in regard to ITG in this study, might be explained by neural adaptations.

Regarding the moment to apply the motor imagery in session training, the scientific literature indicates that it should be inserted before physical training session because physical fatigue impairs mental images creation (Demougeot and Papaxanthis, 2011; Di Rienzo, Collet, Hoyek and Guillot, 2012), which might impair the effectiveness of the motor imagery training program. Di Rienzo et al. (2012) showed that physical fatigue that occurs during an intense sport session altered motor imagery ability in swimmers. Demeougeot and Papaxanthis (2011) revealed that mental representations of actions were altered by muscle fatigue in adults. Therefore, it seems that mental fatigue influences action planning and emphasize the interdependence of motor and cognitive states. Due to the consistent use of motor imagery training, alone or in combination with physical training, sports psychologists should take into consideration physical and/or mental fatigue in the development of training programs. Specifically, this study adopted motor imagery training thirty minutes after physical/technical training because it was used the imagination of a simple motor gesture (tennis). In addition, although it is recommended to perform motor imagery training before physical training session (Papaxanthis and Demougeot, 2011; Di Rienzo et al., 2012), several other studies showed positive motor imagery training effects after (Fortes et al., 2016; Fortes et al., 2018) or during (intervals of aerobic session) physical training sessions (Guillot et al., 2015). Furthermore, Kanthack et al. (2016) revealed that when athletes are physically exhausted, the imagery of a simple motor gesture (known as static motor imagery) might improve accuracy performance. Regardless of when motor imagery training is applied, it is important to assess whether the athlete presents physical fatigue state before the execution of motor imagery training.

Considering the maintenance of tennis service performance in CG, it is important to note that the participants were moderately trained (state level). The higher the level of the athlete, the higher the training time necessary for significant performance improvement. Moreover, findings showed that amateur athletes improved sport performance independent of volume and intensity training (Clemente-Suárez, Delgado-Moreno, González, Ortega and Ramos-Campo, 2018). In the case of moderately trained athletes, eight weeks of training is not enough to enhance the tennis service performance. Another explanation is assuming that physical training was not strong enough to enhance tennis service performance in CG.

The present study, despite the interesting results, has limitations that should be mentioned. The tennis service technique used in the groups (ITG and CG) was not evaluated, which might influence performance, although the athletes already had at least two years of training. Results could be better analyzed using kinematic analyses of tennis service performance using video. Finally, the lack of analysis of brain electrical activity (brain waves) may also indicate another limitation. However, to analyze brain signal during tennis service task is unfeasible. Thus, the findings should be treated with caution. Therefore, it is recommended that future researchers control the technique in service tennis, analyze muscular EMG activity and control brain waves signals (e.g., alpha, beta, and theta) analyzed in the electroencephalogram during motor imagery training sessions. Finally, the strengths of this study were its inclusion of a CG, the participation of high quantitative tennis athletes, and the performance of a chronic effect experiment (eight weeks), thus, filling a gap in the literature in the area of motor imagery training with tennis athletes.

Conclusion

Considering the research findings, the study concluded that motor imagery training might be an effective strategy to enhance tennis service performance among young male tennis players. In summary, it is recommended to include cognitive-specific motor imagery training within the practice routine of young male tennis players.

Efecto del entrenamiento de imágenes motoras en el rendimiento del servicio de tenis en atletas de tenis jóvenes

Resumen

El objetivo del estudio fue analizar el efecto del entrenamiento de imágenes en el rendimiento del tenis de servicio entre los atletas de tenis. Los participantes fueron 28 tenistas jóvenes, divididos aleatoriamente en dos grupos: formación en imágenes (ITG, n = 14) y grupo de controlo (CG, n = 14). Es una investigación experimental controlada y aleatorizada, que dura ocho semanas. El CG miró videos sobre la historia de los Juegos Olímpicos, mientras que ITG hizo entrenamiento de imágenes. El rendimiento del tenis de servicio se obtuvo por el producto entre precisión y velocidad de carrera [precisión x velocidad media de todos los golpes (km/h)]. Se identificó el efecto de interacción grupo contra tiempo ($p < .01$) para todos los indicadores de rendimiento [precisión, velocidad de carrera y rendimiento (precisión x velocidad)], con mejoría solo en ITG ($p = .01$). Se concluyó que el entrenamiento con imágenes se puede considerar una estrategia efectiva para mejorar el rendimiento del tenis entre los tenistas.

Palabras clave: tenis, atletas, deporte, psicología del deporte

Efeito do treinamento em imagens motoras no desempenho do serviço de tênis em jovens atletas de tênis

Resumo

O objetivo do estudo foi analisar o efeito do treinamento imaginário sobre o desempenho do saque em atletas de tênis. Participaram vinte e oito jovens atletas de tênis, randomicamente divididos em dois grupos: treinamento imaginário (TI, n =14) e grupo controle (GC, n = 14). Trata-se de investigação experimental randomizada e controlada, com duração de oito semanas. O GC assistiu vídeos sobre a história das Olimpíadas, ao passo que o TI realizou o treinamento imaginário. O desempenho do saque foi mensurado pelo produto entre acurácea e velocidade da bola [acurácea x velocidade média da bola (km/h]. Foi revelado efeito de interação grupo vs. tempo ($p < .01$) para todos os indicadores de desempenho [acurácea, velocidade da bola e desempenho (precisão vs. velocidade)], com melhora somente para o TI ($p = .01$). Concluiu-se que o treinamento imaginário pode ser considerado uma estratégia efetiva para potencializar o desempenho do saque em atletas de tênis do sexo masculino.

Palavras chave: tênis, atletas, esportes, psicologia esportiva

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