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THE INFLUENCE OF COORDINATIVE ABILITIES ON MOVEMENT DURING TENNIS MATCHES

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Abstract: *This paper aims to highlight the importance of coordinative abilities in the training plan of 10-12 year old tennis players, and whether through the methods and means chosen for this experiment an optimisation of tennis specific movements is observed. The ability to combine different forms of movement allows the player to better and faster adapt to the different surfaces they have to play on. In most cases, tennis movement is the combined result of and is constantly conditioned by the court area, technical processes and the player's experience. The results of this study show that the development of coordinative abilities positively influences the player's ability to combine the different types of movements specific to tennis matches.*

Key words: *tennis, specific displacements, coordinative abilities.*

1. Introduction

Success in tennis is inevitably related to the player's movement efficiency while on court and hitting strokes.

Movement on the tennis court represents the automatic set of motions required to prepare the different body segments and the trunk for optimally executing basic or special techniques.

The technical requirements of tennis can be best appreciated when considering that during an average interval of 5 seconds each player hits 3 strokes and moves an average distance of 3 meters at each contact with the ball. During one match, the cumulative distance covered rises to over 900m, and the number of strokes to about 300. During this time, players must coordinate their lower body, upper body and racquet movements in different directions and on different plans.

There are many different types of tennis specific movements, which are the combined result of and are constantly conditioned by the court area, technical processes and the player's experience. Tennis-specific movements include:

- stroke movements;
- movements to return to the strategic area of the court;
- movements for offensive strokes at the net;
- movements to transition between the

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offensive and defensive positioning and vice versa;

•movements intended to confuse the opponent;

•off-game movement (when the ball is not in play).

During tennis, the player's positioning should be balanced, dynamic and economical in terms of physical effort. The player should have permanent control of the racquet which should constantly be adapted to the player's goal.

It is interesting to note that there seems to be a link between the development of coordination and agility. Young sportsmen who learn how to master the elements associated with good coordination (balance, rhythm, spatial orientation, reaction, etc.) reach a much more advanced level than those who are not exposed to this type of exercise until older. The ability to develop optimal coordination skills ends around the age of 16. This justifies the fact that early and total exposure is the key to good sports training. Global coordination skills will serve as the basis for developing specific coordination skills during adolescence.

2. Objectives

For 10-year olds who want to later reach their maximum athletic potential, emphasis must be placed on learning the 'abc' (agility, balance and coordination) of motor skills alongside those of running, jumping, throwing and catching. Good movement allows the tennis player to better and easier adapt to the different court surfaces they will eventually play on.

In this paper I intend to highlight the importance of coordinative abilities in the training plan of 10-12-year-old tennis players, and whether through the methods and means chosen for this experiment an optimisation of tennis specific movements is observed.

The main hypothesis of this paper is that coordinative abilities developments, which are very important in this age category, can be accomplished through dynamic and attractive means carefully selected by the tennis coach. Naturally, the question arises whether coordinative abilities development does optimise tennis specific movements in the present study and in what proportion.

The proposed experiment aims to devise an athletic training process with a view to develop coordinative abilities and asks whether the development and expression levels of these abilities positively influence the tennis specific movements.

3. Material and Methods

The subjects included in this paper are athletes from the Dacia Galaţi Sports Club during the period of April 2018 to June 2019. The paper represents a comparative study on the development of coordinative abilities and their influence on tennis-specific movements.

At the beginning of September 2018, the control (GR MAR) and the experiment groups (GR EXP) were formed from athletes belonging to the Dacia Galaţi Sports Club. Each group is made up of 6 tennis players, with 3 girls and 3 boys in the 10-12 years old category. Both groups had similar conditions.

Assessments were carried out at the beginning of the school year (initial assessment) and at the end of the school year (final assessment). As the goal of our research was to determine the influence of coordinative abilities on the tennis-specific movements, all planning documents were created so that they ultimately lead to the achievement of this set goal.

4. Results and Discussions

Given that the development of coordinative abilities does not depend so much on the sex of the subjects as in the case of strength and motor quality, we did not consider it necessary to make interpretations from this point of view. In order to be as objective as possible, all the measurements performed were interpreted without taking into account the sex of the subjects.

The resulting data from the initial and final assessments were analysed as the evolution between the two assessments.

The final assessment data was also compared between the two groups.

4.1. The dynamics of coordinative abilities

To evaluate the coordinative abilities 4 assessments were chosen, with 2 regarding eye-foot coordination (the square test and the hexagonal obstacle test) and the other 2 regarding hand-eye coordination (pendulum-target throwing and target throwing while facing the opposite direction).

For the two groups, the calculated statistical indicators are shown in Table 1.

Table 1

Coordinative abilities assessment

	Assessment	Experiment group				Control group			
		TI		TF		TI		TF	
		$\bar{x}$	cv	$\bar{x}$	cv	$\bar{x}$	cv	$\bar{x}$	cv
1	Square test (sec.)	11,92	3,62	11,42	3,15	12,05	3,66	11,73	2,73
2	Hexagonal obstacle test (sec.)	11,13	8,34	10,45	5,60	10,98	6,13	10,62	5,47
3	Pendulum-target throwing(pt.)	7,50	13,98	8,67	11,92	7,33	16,51	8,17	9,22
4	Target throwing while facing the opposite direction (pt.)	11,33	17,35	13,83	10,64	11,50	19,64	13,33	9,08

The averages obtained following the “Square test” assessments show that both groups experienced positive evolution (Figure 1).

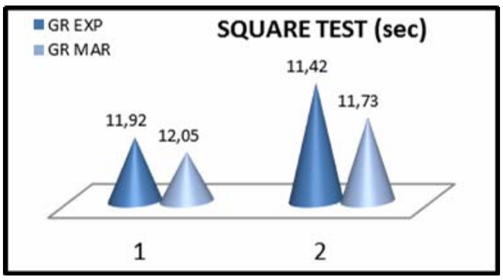

Fig. 1. *Comparative analysis of the “Square test” assessment*

The control group progressed by 0.32 seconds, which represents an increase of 2.66% over the initial assessment. Similarly, the experiment group progressed by 0.5 seconds, an increase of 4.19% over the initial assessment. Comparing the two groups, the experimental group improved almost twice as much as the control group. While at the initial assessment the difference between the two groups was 0.13 seconds in favour of the experiment group, at the final assessment the difference was of 0.31 seconds, again in favour of the experiment group. Thus, the difference between the two groups almost tripled at the time of the final assessment.

For the "Hexagonal obstacle test" we noticed that the control group progressed from an average of 10.98 seconds at the initial assessment to 10.62 seconds at the final assessment. The absolute progress of this group is 0.36 seconds, which represents a 3.28% increase. Similarly, the experiment group athletes positively improved their performance. From an initial average of 11.13 seconds at the initial assessment, the group reached an average of 10.45 seconds at the final assessment (Figure 2). Therefore, the experiment group improves by 0.68 seconds in absolute value and by 6.11% as a relative increase.

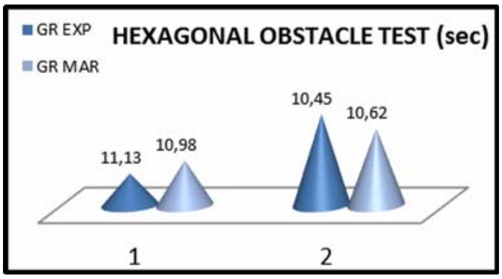

Fig. 2. *Comparative analysis of the "Hexagonal obstacle test" assessment*

While at the time of the initial assessment the difference between the two groups was of 0.15 seconds in favour of the control group, at the final assessment the situation changes, with a difference of 0.17 seconds in favour of the experiment group.

For the "Pendulum-target throwing" assessment the evolution of the two groups is shown in Figure 3. Both groups have a positive progression, with the control group improving by 0.84 points (11.46%) and the experiment group improving by 1.17 points (15.6%). If at the initial assessment the difference between the two groups was of only 0.17 points in favour of the control group, at the final assessment this difference reached 0.5 points in favour of the experiment group.

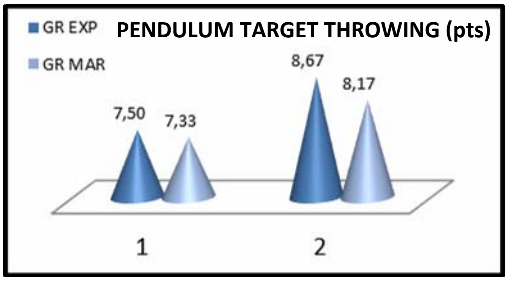

Fig. 3. *Comparative analysis of the "Pendulum-target throwing" assessment*

On the basis of this evidence, it can be concluded that the experiment group had a greater progress than the control group.

In the case of the "Target throwing while facing the opposite direction" assessment (Figure 4), a hand-eye specific coordination assessment, we noticed that the control group registered mean progression improved from 11.5 points at the initial assessment to 13.33 points at the final assessment (Figure 4). The absolute value increase is 1.83 points, a 15.91% increase over the initial value. The experiment group average was 11.33 points at the initial assessment and 13.83 points at the final assessment. This represents an absolute value increase of 2.50 points or a percentile improvement of 22.06%.

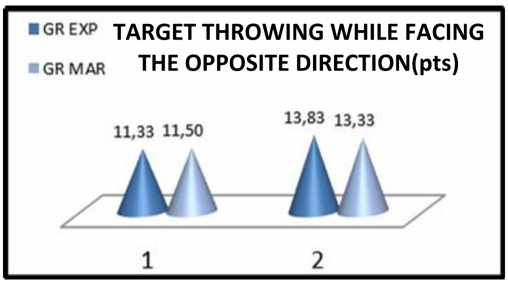

Fig. 4. *Comparative analysis of the "Target throwing while facing the opposite direction" assessment*

The difference between the two groups at the initial assessment was 0.17 points in favour of the control group, while at the final assessment the difference was of 0.5 points in favour of the control group.

If at initial assessments the means randomly assign superior performance to either the control or experiment group, at the final assessment the best performance is strongly associated with the experiment group. We can thus conclude that both groups show a natural improvement, with the more pronounced evolution attributed to the experiment group.

4.2. Evolution of tennis specific movements

To evaluate tennis-specific movement 4 assessments were used. The “Spider run test” assessment measured movement speed on the court, coordination and the ability to accelerate and brake over short distances, in different directions and in different stances. We also assessed movement speed while doing side shuffles and the ability to stop and change direction. The "T - test" assessment evaluated the athlete's ability to combine forward, backward and lateral movements, while the "505 - test” assessed the ability to accelerate and brake over short distances.

In this regard, for the evaluation of the level of movement in the tennis match, both groups underwent a collection of 4 relevant tests, whose calculated statistical indicators are presented in table 2.

Table 2

Assessment of tennis specific movement

No.	Assessment	Experiment group				Control group			
		TI		TF		TI		TF	
		$\bar{x}$	cv	$\bar{x}$	cv	$\bar{x}$	cv	$\bar{x}$	cv
1	Spider run test(sec.)	18,15	4,70	17,37	2,67	18,05	3,74	17,62	2,42
2	Side shuffles (sec.)	7,73	5,09	7,38	2,89	7,88	6,73	7,68	5,67
3	„T” – test (sec.)	14,53	6,61	13,83	5,40	14,38	3,82	14,12	4,09
4	Test 505 (sec.)	3,70	7,45	3,45	5,42	3,80	6,45	3,63	7,11

For the “Spider run test” assessment we noticed that both groups had a natural positive evolution. In the case of the experiment group, the average improved from 18.15 seconds at the initial assessment to 17.37 seconds at the final assessment. This represents an absolute improvement of 0.78 seconds or percentile improvement of 4.3%. The control group registered an evolution of 0.42 seconds (2.38%) as it progressed from an average of 18.05 seconds at the initial assessment to 17.62 seconds at the final assessment (Figure 5).

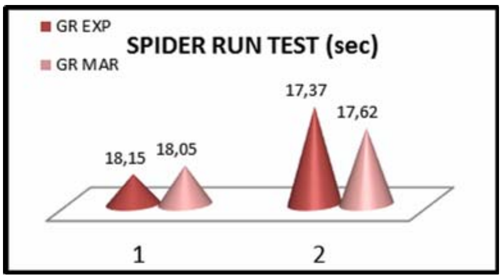

Fig. 5. *Comparative analysis of the “Spider run test” assessment*

The difference between the 2 groups is 0.36 seconds in favour of the experiment group. At the initial assessment the difference between the experiment and the control groups was of only 0.1 seconds, while at final assessment the difference reached 0.25 seconds both in the favour of the experiment group.

For the "side shuffles" assessment, both groups show improvement, with more progress in the experiment group. The experiment group progresses from an average of 7.73 seconds at the initial assessment to 7.38 seconds at the final assessment (Figure 6). The control group starts at 18.05 seconds and improves to 17.62 seconds at the final assessment. This equates to 0.35 seconds absolute increase for the experiment group and 0.20 seconds for the control group, or 4.52% and 2.7% respectively. At the time of the initial testing there was a 0.15 second difference between the two groups in favour of the experiment group, while at the time of the final assessment the difference reached 0.3 seconds again in the favour of the experiment group.

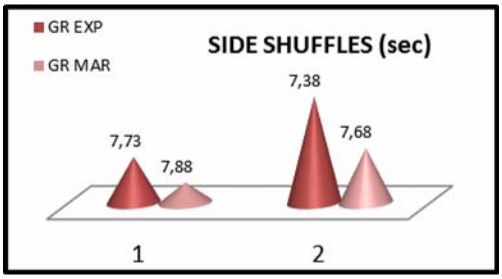

Fig. 6.*Comparative analysis of the "side shuffles" assessment*

The "T-test" assessment wishes to evaluate the athlete's ability to combine forward, backward and lateral movements, combination which is very often needed during tennis matches. The resulting averages at the initial assessment show a difference of 0.15 seconds in favour of the control group, which changes to 0.29 seconds in favour of the experiment group at final assessment (Figure 7). The experiment group improved by 0.7 seconds (4.81%) and the control group improved by 0.26 seconds (3.52%).

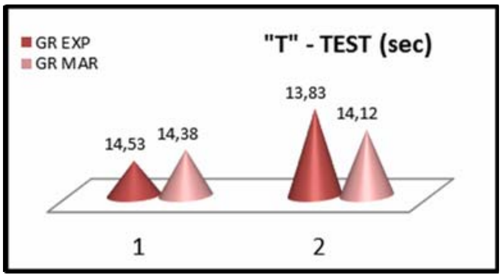

Fig. 7.*Comparative analysis of the "T-test" assessment*

As was the case for the other assessments, the group mean performances registered by the "505 – test" at the initial assessment were very similar between the two groups. The difference between the two groups during the initial assessment was 0.10 seconds, in favour of the experiment group. This time gap increased to 0.18 seconds during the final assessments also in favour of the experiment group.

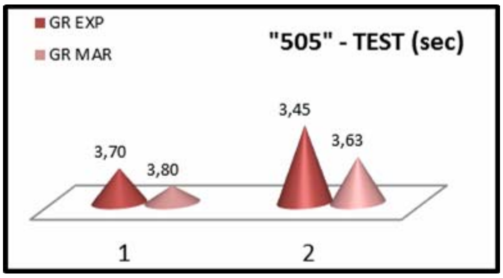

Fig. 8. *Comparative analysis of the "505 - test" assessment*

Thus, the experiment group progressed between the two assessments from an average of 3.70 seconds to 3.45 seconds, resulting in a 0.25 seconds improvement.

The control group improved from an average of 3.80 seconds at the initial assessment to an average of 3.63 seconds at the final assessment.

5. Conclusions

Following the statistical analysis based on the initial and final assessments designed to evaluate coordinative abilities, we may conclude that both groups show a natural improvement, with a more pronounced progress in the case of the experiment group.

To evaluate the level of the tennis-specific movements, the two groups underwent a combination of 4 relevant tests, resulting in the following measurements:

- For the "Spider run test" assessment, both groups registered a certain progress; however this was more significant in the case of the experiment group. The average for this group improves from 18.15 seconds to 17.37 seconds between the initial and the final assessments (a progress of 0.78 seconds), while the control group showed only a progress of 0.42 seconds, from 18.05 seconds at the initial assessment to 17.62 at the final assessment;
- The means calculated for the "side shuffles" assessment show a 0.35 seconds absolute improvement for the experiment group and a 0.20 seconds absolute improvement for the control group. These two values translate to percentile improvements of 4.52% and 2.70%, respectively;
- For the "T – test" assessment, the mean performance evolution shows a 0.70 seconds improvement for the experiment group and a 0.26 seconds improvement for the control group. These translate to percentile improvements of 4.81% and 3.52%, respectively;
- For the "505-test" assessment, the experiment group progressed between the two assessments from an average of 3.70 seconds to an average of 3.45 seconds (a 0.25 seconds improvement), while the control group improves from an average of 3.80 seconds at the initial assessment to an average of 3.63 seconds at the final assessment.

The experiment group has registered superior performance improvements during the coordinative abilities assessments, due to the specifically designed means to improve this capacity. While this was expected, after analysing and interpreting the results from our specifically devised tennis movement assessments, we may conclude that the improvement of coordinative abilities positively correlates with the improvement of tennis-specific movements.

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