

Correlation between Hand Grip Strength and Hand Eye Coordination with Performance in Adolescent Tennis Players

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Abstract: *Background:* Many daily functions and sporting events such as wrestling, tennis, football, basketball, and baseball require high activity levels of the flexor musculature of the forearm and hand. These are the muscles involved in grip strength. Tennis is a dynamic sport played with a racket and a ball. Tennis is also one of the sports that need, besides balance and coordination skill, characteristics such as strength, endurance, speed and flexibility. Strength is required in muscles and joints both for performance (ball velocity) enhancement and to reduce injuries. In tennis, eye hand coordination is necessary for ball control, speed, and rapidity to react on environmental changes, agility, and reaction. Hence the grip strength & hand eye coordination plays a significant role in ultimate performance in sports. So the purpose of the study is to find out if there is any correlation between grip strength and hand eye coordination with performance in adolescent tennis players. *Aim:* To study correlation between hand grip strength and hand eye coordination with performance in adolescent tennis players. *Methodology:* The study design was correlation in nature. Total of 30 subjects of age group 13-16 years, who fulfilled the inclusion criteria were selected for study. The subject were asked to performed grip strength measurement using Jamar dynamometer and hand eye coordination score by demonstrating hand eye coordination test and technical effectiveness % by demonstrating field test for performance. Karl pearsons correlation coefficient was used for data analysis. *Result:* The result shows that the hand eye coordination was significantly correlated with ($r=0.384^*$, $p=0.036$) performance of adolescent tennis players. *Conclusion:* With the result it concluded that there is significant correlation between hand eye coordination and performance of adolescent tennis players.

Keywords: Grip Strength, Hand Eye Coordination and Performance

1. Introduction

Many daily functions and sporting events such as wrestling, tennis, football, basketball, and baseball require high activity levels of the flexor musculature of the forearm and hand. These are the muscles involved in grip strength. From sports like wrestling, tennis, football, basketball, and baseball to daily activities such as carrying laundry, turning a door knob, and vacuuming, some degree of grip strength is necessary to be successful. For example, without adequate grip and forearm strength, tennis players may run the risk of developing lateral epicondylitis, otherwise known as tennis elbow. Often overlooked or taken for granted, the strength of one's grip plays a key role in injury prevention and overall strength development.^{1,2,3,4}

Tennis is a dynamic sport played with a racket and a ball. Tennis is also one of the sports that need, besides balance and coordination skill, characteristics such as strength, endurance, speed and flexibility.⁵ A vital concern of tennis performance is the ability to repeat intermittently muscular force at high speed. Nevertheless, the ultimate functional performance of any complex chain of torque transfers (i.e., serve or ground strokes in tennis) depends on several factors including technique, flexibility, muscle strength, speed, and power. Standardized testing is commonly used to provide a useful supplement to subjective coaching appraisals in an attempt to assess strengths and weaknesses of a given player.⁶

Strength is required in muscles and joints both for performance (ball velocity) enhancement and to reduce injuries. Solid contact between the racket and the ball is

required for optimum stroke execution, and this is influenced by grip strength.⁷

Coordination is the ability to repeatedly execute a sequence of movements smoothly and accurately. In tennis, eye hand coordination is necessary for ball control, speed, and rapidity to react on environmental changes, agility, and reaction.⁸ Good eye hand coordination increases the player's ability to perform complex movement, respond effectively to external stimuli and create fluent movement. In relation to tennis eye hand coordination helps the player in proper positioning of the racket as well as to control the arm velocity and direction of hit.⁹

The objective of the hand eye coordination test is to monitor the ability of the athlete's vision system to coordinate the information received through the eyes to control, guide, and direct the hands in the accomplishment of hitting a ball (hand-eye coordination).⁸

Athletic performance is, to a large degree, dependent on the athlete's ability to sustain power (both anaerobically and aerobically) and to overcome resistance, or drag. Both of these factors are interrelated with the athlete's body composition.¹⁰ Several tennis-specific test procedures have been used to determine the exercise capacity and technical performance of athletes with acceptable accuracy under standardized condition.¹²

Hence the grip strength & hand eye coordination plays a significant role in ultimate functional performance of any complex chain of muscular activity & torque transfers required in sports. Therefore, the aim of this study is to

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identify correlation between grip strength and hand eye coordination with performance in adolescent tennis players.

2. Methodology

Subject those fulfilled inclusion criteria were selected for study. After a verbal description of the method of testing, testing was demonstrated to the subjects and informed consent had been taken.

TO MEASURE THE GRIP STRENGTH

For the test of grip strength, subject were seating with his shoulder adducted and neutrally rotated, elbow flexed at 90° and the forearm and wrist in neutral position. The handle of the dynamometer is adjusted if required - the base should rest on first metacarpal (heel of palm), while the handle should rest on middle of four fingers. When ready the subject squeezes the dynamometer with maximum isometric effort, which is maintained for about 5 seconds. No other body movement is allowed.¹¹

To measure the hand eye coordination score

The athlete warms up for 10 minutes. The athlete stands two meters away from a smooth wall .The assistant gives the command "GO" and starts the stopwatch .The athlete throws a tennis ball with their right hand against the wall and catches it with the left hand, throws the ball with the left hand and catches it with the right hand. This cycle of throwing and catching is repeated for 30 seconds. The researcher counts the number of catches and stops the test after 30 seconds .The researcher records the number of catches. ⁸

To examine performance by field test

Test performs on outdoor tennis court. Measurements began after an 18-minute standardized warm-up, which consists of 10 minutes of jogging around the court, dynamic flexibility, forward, sideways, and backward running, and acceleration runs; 5 minutes consisting of ground strokes and 3 minutes of test familiarization, performing the test protocol at the lowest work load (frequency of balls ejected from the ball machine [Ball f] = 9 shots per minute).

Test duration between 8 and 20 min. balls should be alternatively projected by a ball machine to the right and left corners of the baseline. Participants have to hit alternating forehands and backhands cross court in prescribed pattern.

The landing point for the balls was chosen about 2m in front of the baseline. The test begin with a ball of 9 shots per min. Which are increased by 2 shots per min in every 2 min. the test ended at the players request or stop by the researcher. If the player is no longer able to fulfill the test criteria. That is the player is no longer to perform strokes with acceptable stroke technique and precision.

Technical effectiveness (T.E) calculated on the basis of the performance of the hits and the errors.

T.E% of the test, percentage of correct hits. ¹²

3. Result

The subject selected in the study had a Mean age of 13.8±1.09 years, Mean height of 160.4±5.48 cm and Mean weight of 49.73±6.56 kg.

Table 4.1: Relationship (correlation coefficient) between hand grip strength of dominant hand with hand eye coordination

	N	HEC
GS(D)	30	r =0.199, p=0.292

Table 4.2: Relationship (correlation coefficient) between hand grip strength of non dominant hand with hand eye coordination

	N	HEC
GS(ND)	30	r =0.282, p=0.132

Table 4.3: Relationship (correlation coefficient) between hand grip strength of dominant hand with technical effectiveness

	N	TE
GS(D)	30	r=0.072, p=0.704

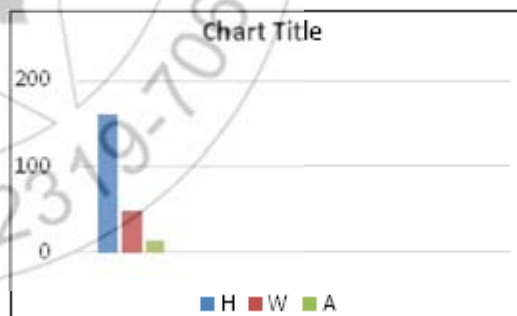
Table 4.4: Relationship (correlation coefficient) between hand grip strength of non dominant hand with technical effectiveness

	N	TE
GS(ND)	30	r=0.120, p=0.528

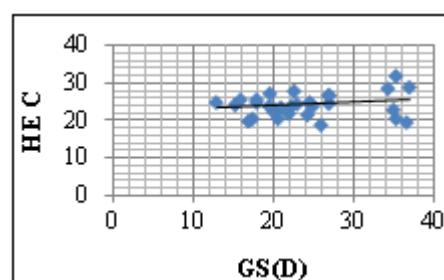
Table 4.5: Relationship (correlation coefficient) between hand eye coordination with technical effectiveness

	N	TE
HEC	30	r=0.384*, p=0.036

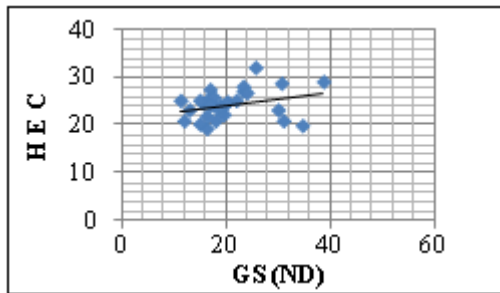
*Correlation coefficient significant at p<0.05



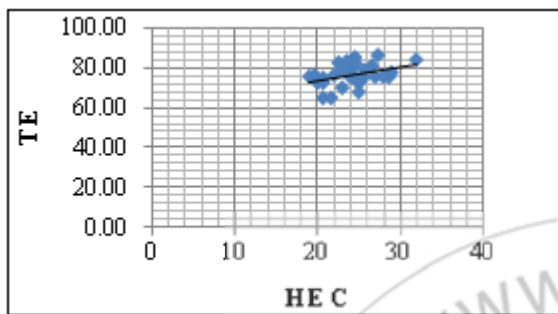
Graph 4.1: Mean of Height, Weight and Age of adolescent tennis players



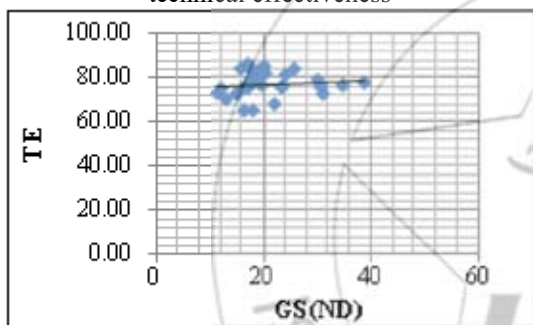
Graph 4.2: Correlation between grip strength of dominant hand and hand eye coordination



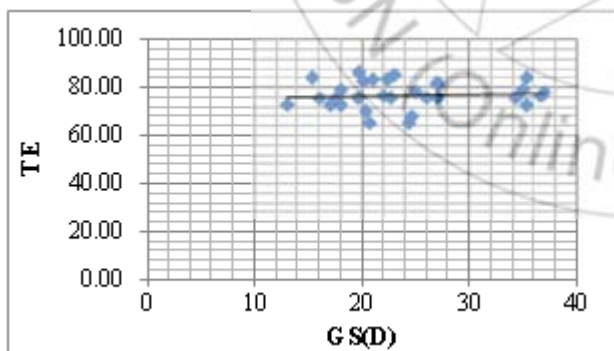
Graph 4.3: Correlation between grip strength of non dominant hand and hand eye coordination



Graph 4.4: Correlation between hand eye coordination and technical effectiveness



Graph 4.5: Correlation between grip strength of non dominant hand and technical effectiveness



Graph 4.6: Correlation between grip strength of dominant hand and technical effectiveness.

4. Discussion

The purpose of the study was to find out the correlation between hand grip strength and hand eye coordination with performance in adolescent tennis players. A total number of 30 tennis players were included in the study. The hand eye coordination score was measured and it was further correlated with the technical effectiveness of tennis players. The result of the study showed that there was significant

correlation existing between hand eye coordination and technical effectiveness ($r= 0.384, p=0.036$).

Study by Maman Paul, Sandeep Kumar Biswas, Jaspal Singh Sandhu on role of sports vision and eye hand coordination training in performance of table tennis players showed that improvement in hand eye coordination, motor performance of the players after visual variables training shows that hand eye coordination is improved with improvement in motor performance.⁹

This may be due to level of the hand eye coordination ability is expressed in the game. The ball hitting precision influences further the precision of hitting various parts of the court. Hence hand eye coordination and motor Performance may be linked with each other.

In our study there was no significance correlation obtained between hand grip strength and hand eye coordination, and between hand grip strength and performance of adolescent tennis players.

Hence our study results have been partially accepted & supported by above studies and therefore the experimental hypothesis “there is correlation between hand eye coordination and performance of adolescent tennis players” is accepted.

5. Conclusion

The study concluded that there is significant correlation between hand eye coordination and performance of adolescent tennis players.

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