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# Correlation Between Hand Eye Coordination and Agility in Recreational Squash Players

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**Abstract:** ***This study aims to assess the correlation between hand-eye coordination and agility in recreational squash players aged 18-35 years. Squash, a fast-paced racquet sport, requires players to exhibit high levels of agility and precise hand-eye coordination to effectively respond to the ball and maintain control during rapid movements. Agility involves the ability to quickly change direction and speed while maintaining balance, while hand-eye coordination is critical for accurate ball control and racquet positioning. The study utilized the Alternate Wall Toss Test to measure hand-eye coordination and the Agility T-Test to evaluate agility in 30 participants. The findings revealed a moderate negative correlation between hand-eye coordination and agility, indicating that as hand-eye coordination improves, the time taken to complete the agility test decreases. This suggests that enhancing both skills simultaneously may lead to better performance and reduced injury risk in squash players. The study highlights the importance of incorporating agility and hand-eye coordination drills into training programs for recreational squash players to enhance overall performance.***

**Keywords:** squash, agility, hand-eye coordination, recreational players, performance improvement

## 1. Introduction

Squash is a racquet sport played by two players (or four players for doubles) in a four-walled court with a small hollow rubber ball. Squash players are characterized by their ability to undertake repeated high intensity movements like accelerations, decelerations and change of direction over short distances (3-6 m), throughout the rallies lasting 15-30s (1). The match is won normally by a perfect amalgam of physical condition, mental attitude, courage, intelligence and the players technical skill and tactical efficiency. It requires physical and mental attitudes to be in top gear to tackle all eventualities in the match. It calls for a coordinated functioning of the body and its reflexes. (2)

Agility is the ability to explosively start, decelerate, change direction and speed up again quickly while keeping the body in control and restricting decrease in speed. Agility has not only been characterized as the capacity of a player to change their direction rapidly but also with utter precision. Agility is one of the critical components of any sport (3). It includes the aggregate capacities of a player which helps which helps the athlete to do a group of movements with better quality and effect. Benefits from improved agility include increased body control during quick movements, increased intramuscular coordination, increased reaction time and decrease in the risk of injury or reinjury. (3) Squash players need to be able to move fluidly and with agility in order to position themselves for shots, defend opponent's shots and to avoid contact. Being able to quickly change direction forward, backward and laterally is going to be a key to your success on the court.

Coordination is the ability to repeatedly execute a sequence of movements smoothly accurately. In squash, hand eye coordination is necessary for control of the ball, speed and rapidly to react environmental changes, agility and reaction. Good hand eye coordination increases the player's ability to perform complex movement, respond effectively to external stimuli and create fluent movement. In relation to squash, hand eye coordination helps the player in proper positioning of the racquet as well as to control the arm velocity and direction of hit. 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) (4).

Hence the agility and hand eye coordination plays a significant role in ultimate performance of any complex chain of muscular activity and torque transfers required in sports. No such study which has been specifically conducted to assess agility and hand eye coordination is recreational squash players to my best knowledge. Thus the main aim of this research is to assess the correlation between hand eye coordination and agility in recreational squash players.

**Need for the study**

Agility as a measure is very important in squash because the player has to stop and change directions very quickly throughout the game.

It also requires good hand eye coordination so as to repeatedly see the ball and adjust the body accordingly so that the player can hit back and use competitive stress forces to perfectly hit the target and destination.

Agility and hand eye coordination are one of the two most crucial parameters that determine the performance of squash players. No such study has been done to assess the correlation between these two parameters to my best knowledge.

Lack of hand eye coordination may result in injury to the patient while playing. This may affect the performance of the player and therefore hand eye coordination is an important skill in squash players.

Since these players are recreational, they are not aware of these important skills. So, they are more prone to injuries and hence it is essential to train these players for such skills in order to prevent injuries.

## 2. Review of Literature

1) **Memet Muhumad, Mia Kusumawati, Janky Dewi Amar, Abdul Bon; Correlation analysis of Hand eye coordination and agility athlete cricket Bekasi city proceedings of the 5th international conference on industrial engineering and operation management, Michigan, USA: Aug 10-14-2020**

The study was conducted in Islamic University of 45 Besakih, the total number of participants were 14 male athletes, and the study duration was 2 months comprising testing agility using t test and hand eye coordination using alternate wall toss test in 14 male athletes. Various components were tested like hand eye coordination, fielding skills and agility test. It was found that there is a relationship between eye hand coordination and on fielding skills which was calculated by an agility test.

2) **Bhanu Priya Pipal, Davinder K. Gaur, Jyoti Dahiya: Correlation with performance in Adolescent Tennis players: International Journal of Science and Research (IJSR) ISSN:**

The study design was correlation in nature. Total of 30 subjects of age group 13-16 years fulfilling the inclusive criterion were elected for study. The subject were asked to performed grip strength measurement using dynamometer and hand eye coordination score by demonstrating hand eye coordination test.

The result concluded that there is significant correlation between hand eye coordination and grip strength.

3) **Shloka Jayawant, Dr. Victoria Kuttan Assessment and comparison of agility in Cricketers depending on their playing positions: International Journal of Science and Healthcare research: July-Sept 2022**

An observational study was conducted on 30 players and divided into 3 groups; batsman, bowler and wicket keepers. The agility T-test was used to measure agility. Data was analysed using the software graph pad prism, Normality of the data was calculated using the Shapiro Wilk test and comparison between the groups was done using One Way ANOVA test. It was revealed that the agility timing scores of the cricket players varied according to their position. According to the normative values of Agility T-test, batsman and wicketkeepers showed good agility scores whereas bowlers showed average scores for the same. The mean agility scores of batsmen were recorded as 10.06 secs, wicketkeepers at 10.11 seconds bowlers at 10.60 secs.

**Aim**

To assess the correlation between hand eye coordination and agility in recreational squash players in the age group of 18-35 years.

**Objectives**

1) To assess hand eye coordination by using **Alternate wall toss test** in recreational squash players in the age group of 18-35 years.
2) To assess the agility by using the **Agility T-Test** in recreational squash players in the age group of 18-35 years.
3) To assess the correlation between **Hand Eye Coordination and Agility** in recreational squash players in the age group of 18-35 years.

**Hypothesis**

**Null Hypothesis-**

There is no correlation between hand eye coordination and agility in recreational squash players.

**Alternate Hypothesis-**

There is a significant correlation between hand eye coordination and agility in recreational squash players.

## 3. Methodology

**Study design**-Experimental study
**Study Type-**Correlation study
**Study Setting-**Certified sports academy and clubs.
**Study population**-Recreational Squash players of both genders of age group 18-35 years
**Sampling Technique-**Convenience sampling method
**Sample Size-**30

**Inclusion Criteria-**

1) Recreational Squash players in the age group of 18-35 years.
2) Players willing to participate in the study.
3) Players playing squash for minimum 3 hours/week.

**Exclusion Criteria-**

1) Any musculoskeletal or neurological conditions/injuries in the last 6 months.

**Tools and materials-**

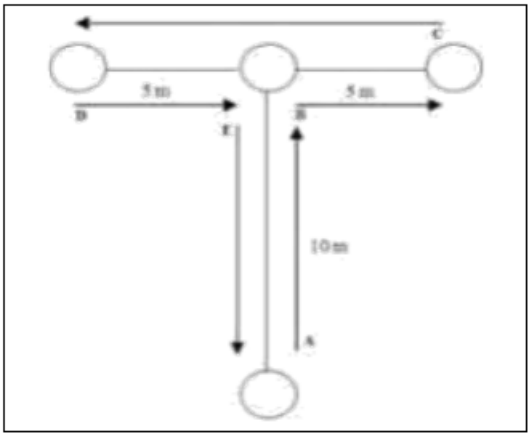
Smooth and solid wall

1.measuring tape 2. Cones 3. stopwatch 4. Tennis ball

**Outcome Measure**

**1) Hand Eye Coordination-Alternate Wall Toss Test**
**Procedure-**

Player stands 2m away from the wall behind a mark, the player first throws a ball from one hand in an underarm action and tries to catch it from the opposite hand. The ball is then thrown back against the wall and is caught by the initial hand; this was recorded as a single action. The test is continued for 3 attemts for a set period of 30 sec.




**Scoring:**

| Rating | Score (In Secs) |
|---|---|
| Excellent | >35 |
| Good | 30-35 |
| Average | 20-29 |
| Fair | 15-19 |
| Poor | <15 |

**Starting position for alternate wall toast test**

**End Position (Catching ball in opposite hand)**

**2) Agility: Agility T-Test:**
**Procedure**

Players are asked to sprint forward from A to B i. e.10m, from the B point the player has to touch the cone at the right sidei.e. cone C by sideways running, the distance being 5m towards point E again by running sideways (5m) and from E to A by backward running (10m), the player sprints for 40m within the time duration of 30 secs and is graded according to table mentioned below.

The test will not be counted if the subject crosses one foot in front of the other while shuffling, fails to touch the base of the cones, or fails to face forward throughout the test. Take the best time of three successive trials.

**Scoring:**

| Ranking | Male | Female |
|---|---|---|
| Excellent | <9.50 | <10.50 |
| Good | 9.51-10.50 | 10.51-11.51 |
| Average | 10.50-11.50 | 11.51-12.50 |
| Poor | >11.5 | >12.50 |

**Procedure**

Approval from the IRB committee was taken and recreational squash players from various academies and clubs were identified.

Recreational squash players from age 18-35 years were recruited and screened for inclusive and exclusive criteria.

On obtaining written consent, players were explained about how the hand-eye coordination assessment and agility test were going to be performed.

Pre-evaluation of the player was don, best out

Hand eye coordination was assessed by Alternate Wall toss test, agility was assessed by Agility T-test after a demonstration best out of 3 scores was considered.

Data was collected and statistically analyzed

**Statistical Analysis**

Data was collected and statistically analyzed using Graph Pad prism (10.1 version) software. Kolmogorov-Smirnov test was used in order to determine the normality of the data that was collected. The data consisted of two variables, Agility and hand eye coordination. Both the components passed normality. Since the data passed normality, a parametric Pearson correlation test was used. The level of significance was $p<0.05$.

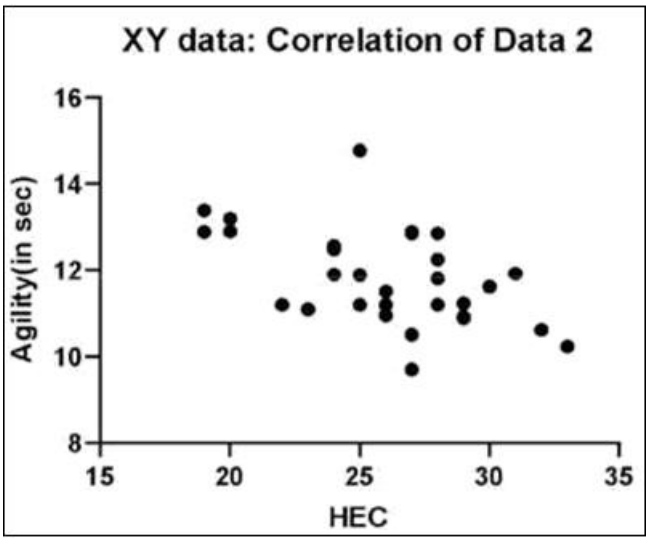
## 4. Result

A total number of 30 recreational squash players were taken in the research. The scores of hand eye coordination were correlated with agility time. After the statistical analysis of the data, it was confirmed that agility and hand eye coordination are correlated ($p=0.0019<0.0019$). Further by using a parametric Pearson correlation test, r=**0.5128.** This states that there is moderate negative correlation between hand eye coordination and agility in these players.

| | |
|---|---|
| R | -0.5128 |
| 95% confidence level | -0.7639 to-0.1780 |

| | |
|---|---|
| P (one tailed) | 0.0019 |
| Significant? (alpha= 0.05) | Yes |

The graphical representation of the data can be described as follows:




- X-axis= hand eye coordination
- Y-axis= Agility (in sec)
- R value= 0.5128
- P value= less than 0.05i.e. significant
- According to the studies of the research, it stated that there is moderate negative correlation between hand eye coordination and agility in these players.

## 5. Discussion

In this study, 30recreational squash players were selected in the age group 18-33 years.26 male players and 4 female players participated in this study. Average age of all players was around 22.7. These participants underwent 2 field tests for calculating their agility and hand eye coordination By Agility-T test and alternate wall toss test respectively. Various factors were taken such as age, gender, BMI and the level at which a player used to perform in the sport. The results of the study demonstrated that there is moderate negative correlation between agility and hand eye coordination in recreational squash players. Hence this data suggests that in order to improve hand eye coordination or agility, the player has to focus and train both the components rather than training either of them individually. Hence this study states that when hand eye coordination score increases, time taken to complete agility T-test decreases. This study suggests that Hand eye coordination has some impact over Agility.

The relationship between hand eye coordination and agility combines aspects of neuroscience, kinesiology and sports science. Biomechanically, hand-eye coordination depends on the interplay between the visual system, the central nervous system, and the musculoskeletal system. The eyes quickly process visual information and transfers it to the brain, which then coordinates the muscles involved in the movement to execute a task with precision. Biomechanically, agility involves coordination between the nervous and musculoskeletal system in order to perform dynamic **activities. Hand eye coordination and agility contribute to biomechanical efficiency and effectiveness in human movements. In sports and rehabilitation contexts, understanding and improving the interplay between hand-eye coordination and agility can lead to better performance and quicker recovery from injuries.**

Good hand eye coordination increases the player's ability to perform complex movements, respond quickly to external stimuli and create fluent movements. The player also has to constantly change direction and needs to be more agile. In squash players, hand eye coordination is very crucial skill as the player has to visualize the ball, direct his hands accordingly as to hit the ball with the racket over a target spot. In one study given by Maman Paul, Sandeep Kumar Biswas, Jaspal Singh Sandhu based on table tennis players stated that the role of hand eye coordination training has significant effect on performance of table tennis players. Improvement in hand eye coordination can be explained by the hypothesis of spatial and temporal coupling of eye and hand as long as the motor reaction relies on visual information. (8) This shows that visual training has some effect over motor agility variables. In relation to table tennis, eye hand coordination helps the player in proper positioning of the racquet as well as control the arm velocity and direction of hit. Hand eye coordination is essential in racquet sports like table tennis and squash because it underpins the core competencies required for success; precision, reaction time, and the ability to read and respond to the game dynamically. These findings strongly support the results of our findings.

Similar research was performed in recreational cricket fielders by Memet Muhammad where they found that there was significant correlation between hand eye coordination and agility in cricket fielders. Since fielders need to run in all directions over the field while fielding and catching (5). Cricket fielders are agile to chase the ball quickly change directions, and dive to make catches or stop boundaries. Similarly Squash players also need good agility to move rapidly across the court, adjusting their positions to hit the ball in time. Excellent hand eye coordination is crucial for both cricket fielders and squash players. In cricket, fielders need to accurately judge the ball's trajectory and speed to catch or intercept it. In squash, players must precisely time their swings to connect with the fastmoving ball. As there is some similarity between sports related skills of a squash player and cricket fielder, this study helps to support the findings pf our study. The hand eye coordination will have impact on agility as they are correlated.

This study suggests that if a player need to improve his hand eye coordination, he has to not only work on this, but has to incorporate various agility training drills as well in his daily program in order to elevate hi game and prevent various injuries. According to a study given by Sneha Baa, Hani Patel, Jasmine Jariwala and Dr. Neeti Mishra, neuromuscular training has a significant effect on Agility, Balance and functional performance in young cricket players. The possible Biomechanical mechanism for improving agility, balance and functional performance could be activation of mechanoreceptors present in the inert structures as a consequence of neuromuscular training, Neuromuscular control and proprioception could have improved as a result Neural adaptation of specific training principle administered in this study (7). Neuromuscular training is crucial for training and enhancing sport performance especially in the physically demanding sport especially in squash game. Neuromuscular training will help to reduce and prevent common squash related injuries such as ankle sprain, knee pain and low back pain. Hence the above study supports the findings of our study.

Hence the study results have been supported by the above studies and hence the experimental hypothesis "There is correlation between agility and hand eye coordination in recreational squash players" is accepted.

## 6. Conclusion

This study concluded that there is significant moderate negative correlation between hand eye coordination and agility in recreational squash players. ($r=-0.5128$, $p<0.05$). This suggests that hand eye coordination has some impact over agility in elevating the skills and performance of a squash player. Correlation between hand eye coordination and agility proves that improving hand eye coordination will have a significant effect on agility in these recreational squash players.

**Clinical Implications**

- Squash requires quick change of direction and movements that requires high level of agility. During the coaching, a tailored drill can be made and players can be trained over and over again by practicing and modifying the components (variations like change in speed, turning, direction of run, multitask while sprinting can also be added).
- Squash promotes good hand eye coordination as repeatedly seeing the ball and adjusting your body and hand so you can hit it back under competitive stress forces the body to hone in on target and destination. Various hand eye coordination drills with the ball and racquet can be incorporated in order to improve the overall performance of the individual.
- Motor learning and adaptation is a crucial factor. Repetitive practice of specific movements will result in good efficiency and effectiveness of neural pathways that are involved in hand eye coordination and agility in squash players.
- Strength and stretching protocol can be added in the training program as developing muscles and improving flexibility of those same muscles that are required for performing full range of motion for performing particular task will contribute in improving hand eye coordination and agility.
- Balance and proprioception training improves the body's ability to position itself optimally and executive movements smoothly. This is crucial for agility and impacts hand eye coordination as well as it helps to stabilize the body, allowing for more precise movements.
- Training to improve reaction time can enhance the speed at which visual stimuli are processed and responded to, thus improving agility and hand eye coordination.

Therefore, in order to improve hand eye coordination, working on agility component is essential and vice versa.

## 7. Limitations and Suggestions

### 7.1 Limitations

- Sample size did not involve much female participants, hence the data analysis was biased only towards male squash players.
- The sampling population did not involve junior players that were below the age group of 18.
- The research conducted was not multicentered, it involved population only from one particular sports academy. The study could have been done from various other sports clubs as well.

### 7.2 Suggestions

- The same study could be done on professional squash players ahead in future.
- Population can be changed from recreational squash players to professional squash players (as every level might have some different protocols.
- More than 2 parameters could be taken and a similar correlation study could have been done in order to improve the overall skills and performance of a player.
- Population size could be increased from 30 to 100.
- A pre and post study can be done by adding an intervention which would include a tailored plan.

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| Serial No. | Age | gender | Hand eye coordination test | | | | Agility T-test(in sec) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | trial 1 | trial 2 | trial 3 | Best score | trial 1 | trial 2 | trial 3 | Best score |
| 1 | 20 | Male | 22 | 21 | 24 | 24 | 11.9 | 12.3 | 12.2 | 11.9 |
| 2 | 21 | Male | 26 | 24 | 28 | 28 | 13.1 | 12.9 | 12.86 | 12.86 |
| 3 | 20 | Male | 18 | 22 | 21 | 22 | 11.9 | 11.5 | 11.2 | 11.2 |
| 4 | 27 | Male | 26 | 27 | 27 | 27 | 9.7 | 9.75 | 10.2 | 9.7 |
| 5 | 18 | Male | 26 | 29 | 27 | 29 | 11.5 | 11.23 | 11.38 | 11.23 |
| 6 | 20 | Male | 30 | 30 | 29 | 30 | 11.95 | 12.08 | 11.62 | 11.62 |
| 7 | 21 | Male | 27 | 28 | 28 | 28 | 11.9 | 12.63 | 11.81 | 11.81 |
| 8 | 18 | Male | 24 | 25 | 23 | 25 | 11.2 | 11.28 | 12.12 | 11.2 |
| 9 | 20 | Male | 26 | 27 | 26 | 27 | 13.1 | 12.95 | 12.86 | 12.86 |
| 10 | 19 | Male | 29 | 32 | 30 | 32 | 10.62 | 10.8 | 10.7 | 10.62 |
| 11 | 25 | Male | 28 | 29 | 28 | 29 | 10.92 | 11.8 | 11.17 | 10.92 |
| 12 | 18 | Male | 30 | 31 | 30 | 31 | 12.35 | 11.92 | 12.48 | 11.92 |
| 13 | 32 | Male | 25 | 27 | 27 | 27 | 11.2 | 10.57 | 10.5 | 10.5 |
| 14 | 18 | Male | 18 | 17 | 20 | 20 | 13 | 12.9 | 12.94 | 12.9 |
| 15 | 19 | Male | 22 | 23 | 22 | 23 | 12.89 | 11.64 | 11.09 | 11.09 |
| 16 | 24 | male | 26 | 24 | 25 | 26 | 11.5 | 11.71 | 11.63 | 11.5 |
| 17 | 21 | Male | 26 | 27 | 25 | 27 | 13.11 | 13.23 | 12.89 | 12.89 |
| 18 | 24 | Male | 25 | 27 | 28 | 28 | 12.3 | 12.36 | 12.25 | 12.25 |
| 19 | 22 | Male | 25 | 26 | 24 | 26 | 11.31 | 10.95 | 10.98 | 10.95 |
| 20 | 27 | Male | 18 | 19 | 20 | 20 | 13.2 | 13.56 | 13.31 | 13.2 |
| 21 | 23 | Male | 24 | 23 | 24 | 24 | 12.48 | 12.57 | 13.01 | 12.48 |
| 22 | 22 | Male | 24 | 24 | 25 | 25 | 14.98 | 15.03 | 14.78 | 14.78 |
| 23 | 19 | Female | 18 | 19 | 16 | 19 | 12.89 | 13.01 | 13.7 | 12.89 |
| 24 | 23 | Female | 24 | 22 | 21 | 24 | 12.56 | 12.88 | 13.38 | 12.56 |
| 25 | 24 | Female | 17 | 19 | 15 | 19 | 13.26 | 13.08 | 13.39 | 13.39 |
| 26 | 22 | Male | 26 | 28 | 28 | 28 | 11.2 | 11.35 | 11.32 | 11.2 |
| 27 | 21 | Male | 25 | 23 | 26 | 26 | 11.2 | 11.28 | 12.23 | 11.2 |
| 28 | 21 | Male | 22 | 24 | 25 | 25 | 11.89 | 12.23 | 12.2 | 11.89 |
| 29 | 23 | Male | 33 | 29 | 31 | 33 | 10.23 | 10.58 | 10.32 | 10.23 |
| 30 | 21 | Male | 28 | 27 | 29 | 29 | 10.89 | 11.21 | 11.08 | 10.89 |