

Comparison of Accommodative Facility in Tennis Players and Non Players

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Abstract

Accommodative facility refers to the speed in which the eye is able to change focus from one distance to another. Tennis is a dynamic sport in which the targets are focused at different distances. Therefore accommodative facility in tennis players and nonplayers has been compared. Thirty -two young male experienced tennis players and thirty- two male nonplayers (did not take part in any racket sports game) were evaluated. The accommodative facility was tested with accommodative flippers (+/-2.00 sphere lenses) binocularly. The subject having 6/6 monocular and binocular near acuity with habitual refractive correction was included in the study. Nonplayers of the same age and sex were included in the study. The mean value of the accommodative facility for the players was 11.92 cpm. The mean value of accommodative facility for the nonplayers was 6.66 cpm and the P value was 0.0005 so there were high statistical significant changes between tennis players and nonplayers. This result can be used to detect sports talents and for players with reduced accommodative facility, vision therapy can be used to improve their facility of ocular accommodation

Keywords: Accommodative facility, tennis players, accommodative flippers

Introduction

Sports vision is a branch of optometry which encounters athletes' ocular health, correction management, protection. vision training to build their performance. Vision triggers the muscle of the body to respond. visual information also feed the athlete what to do, where to do and how to do. Ability to quickly respond to the visual information presented to them can differentiate between skilled and non skilled players. This was been easily defined by the legendary American Football coach, Blanton Collier (1979) who created the concept that 'eye leads the body'.¹ There is an interconnection between sports, body and vision.² All the sports game will enhance human sensory and motor systems. The eyes send visual information to the neural system, the brain analyses and unify the visual data and then feeds out motor signals to the muscles. Various sports will require various visual abilities³

According to American Optometric Association

Visual skills important for tennis

- Visual Acuity
- Peripheral Vision
- Depth Perception
- Eye Motility
- Eye-Hand/Body/Foot Coordination
- Visualization
- Speed of Recognition Time
- Speed of Focusing
- Ability to See in Dim Illumination
- Color Perception
- Fixation Ability
- Central/Peripheral Awareness
- Spatial localization

Accommodation is defined as a process which the ocular system will change its refractive power to bring the object at different distances into focus. Accommodation is specified in terms of diopters (D), that is, in terms of the reciprocal of the object distance. Accommodation required at 40 cm is 2.50 D. The accommodative system consists of Lag of accommodation, Tonic accommodation, Relative accommodation, Accommodative facility, Convergence accommodation. The accommodative facility is the ability of the eyes to focus at different distances and in different sequences in a given period of time. Accommodative facility refers to the speed in which the refractive power of the lens will change to focus at various distances⁴. In any sports facility of accommodation and vergence is important which will direct the visual attention of the athlete to the targets coming from different distances⁵. Holland suggested that poor accommodative facility will affect depth perception and visual processing speeds⁶. Infacility of accommodation is the condition in which the ability to rapidly change accommodation, from far to near distance, is failing or in which a rapid change of accommodation induces symptoms such as asthenopia, headache, and blur.⁷ In tennis, the player needs to focus the moving ball from far to near or vice versa which literally means that accommodative demand plays a major role. Generally, the tennis player will be unable to see the junction of the fast approaching ball with the strings of the racquet. This is mainly due to our restriction inability to track fast- moving objects⁸

Tennis is a game that requires the player to analyze the visual data and react in milliseconds. For many years the players have been told to “watch the ball” and players who failed to do so occurs due to poor visual training. With proper vision training accommodative facility can be improved for tennis players. Gurang Shukala, Maman Paul, Sandhu Jaspal concluded that after vision training there was signification increase in accommodation in tennis players⁹

As a result, the visual system of the tennis players will be more developed and their visual skills will be better than nonplayers.^{10 11}. Therefore accommodative facility between experienced tennis players and nonpayer was compared

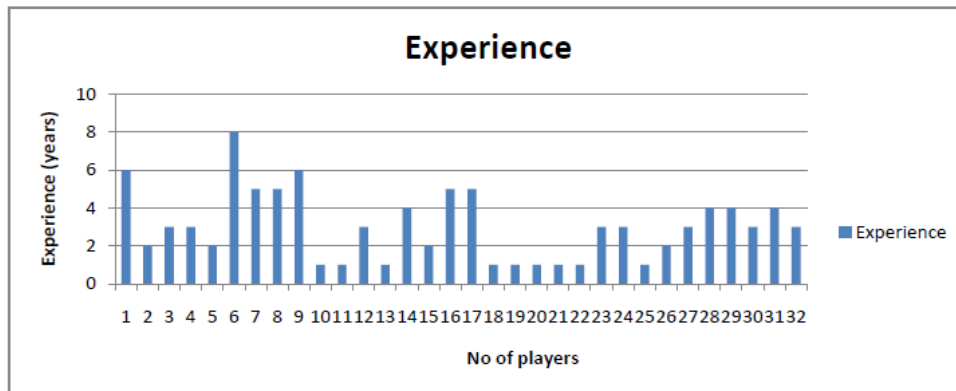
Methods and materials

Thirty- two players having experience of at least one year from different sports academy were randomly recruited into the study. Participation was voluntary and proper permissions were taken. The main difference between table tennis player and control group was that they don't play any sports game seriously or even as a hobby. Players who were taking any specific medications are excluded from the study.

The accommodative facility was tested with accommodative flippers (+/-2.00 sphere lenses) binocularly. A near chart held at 40 centimeters in front of the subject. He was instructed to fixate N8 row in a well illuminated room. The +2.00 sphere lenses are used to initiate the procedure. After the momentary blur the subject is asked to report when the letters sufficiently clear to permit the continuation of letter identification. No other instructions will be given. At this point the lenses will be flipped with -2.00DS replacing the +2.00DS. This constitute one cycle. The subject will be allowed for a maximum of four seconds for a given lens power. after that time lenses will be flipped. If an adequate response is not achieved in four seconds testing will be discontinued and the number of cycles completed in one minute is recorded. The subject having 6/6 monocular and binocular near acuity with habitual refractive correction was included in the study. Non- players of the same age and sex was included in the study. The results of this study were assessed using IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D was used for continuous variables. The Shapiro Wilk's test for Normality showed the data was skewed hence; to find the significant difference between the bivariate samples in Independent groups (Players and NonPlayers) the Mann-Whitney U test was used. In the above statistical tools, the probability value .05 is considered as significant level.

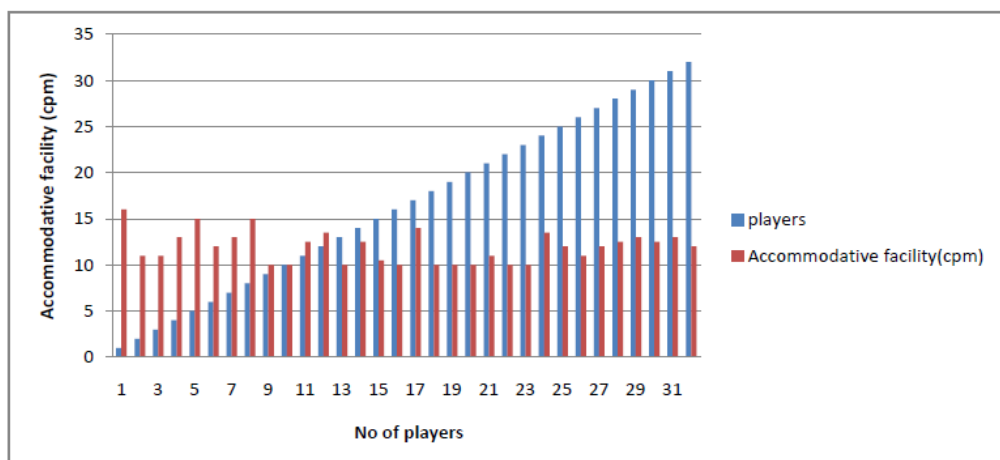
Results

Sixty- four males were included in this study. In this population thirty- two were experienced players and thirty two were nonplayers. The players had a minimum experience of at least one year. Out of the thirty- two, nine players had one year of experience, four players had two years of experience, eight players had three years of experience, four players had four years of experience, four players had five years of experience, two players had six years of experience, and one player had eight years of experience. (Graph 1)



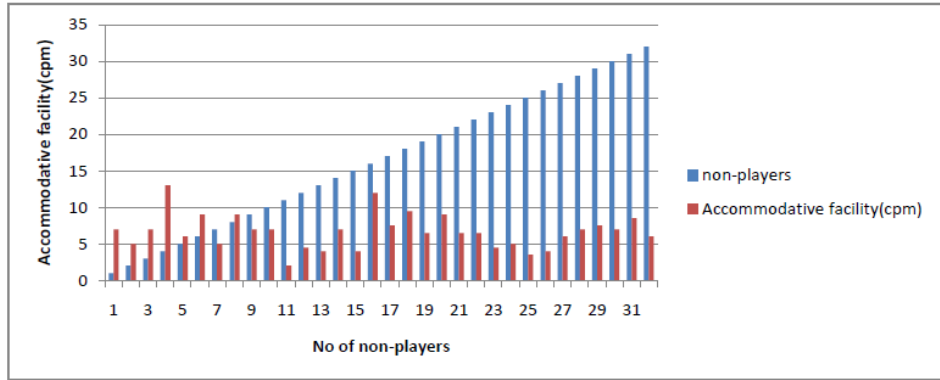
Graph 1. Experience of each player

When subjects were tested with accommodative flippers (+/- 2.00 sphere lenses) nine players had 10 cpm, one player had 10.5, four players had 11 cpm, four players had 12 cpm, four players had 12.5 cpm, four players had 13 cpm, two players had 13.5, one player had 14 cpm, two players had 15 cpm, one player had 16 cpm (Graph 2)



Graph 2. (Accommodative facility of each player)

When non- players were tested with accommodative facility (+/- 2.00 sphere lenses) one non-player had 2 cpm, one non- player had 3.5, three non- players had 4 cpm, two non- players had 4.5 cpm, three non- players had 5 cpm, three non players had 6 cpm, three non- players had 6.5 cpm, seven non- players had 7 cpm, two non- players had 7.5 cpm, one non- player had 8.5 cpm, three non- players had 8.5 cpm, three non- players had 9 cpm, and two non- players had >10 cpm.(Graph 3).



Graph 3. (Accommodative facility of non-players)

The mean value for the accommodative facility of the players obtained was 11.92, and the mean value for accommodative facility of the non- players obtained was 6.66. In this study $P < 0.0005$, and there is high statistical changes between players and non- players (Table 1)

Table 1

Bivariate comparison by Mann-Whitney U test				
Groups	Mean	S.D	Z-Value	P-Value
Players	11.92	1.70	6.357	0.0005 **
Non Players	6.66	2.35		
** Highly statistical significant at $P \leq 0.01$ level				

Discussion

As the results shows, there is a significant difference of accommodative facility between players and nonplayers. Development of accommodative facility may improve the efficiency of the visual system. Tennis sport requires speed, endurance and fast reaction time. The tennis player needs visual skills such as eye alignment for accurate fixation on the ball, eye flexibility in order to shift the focus from far and near.

(Ripoll and Latiri, 1997) Tennis player uses saccadic eye movements for fixation on the ball. Saccadic eye movements are used for rapid screening. Saccades are rapid movements of the eyes that change the point of fixation. Saccades can be evoked voluntarily but occur when the eyes are open, even fixated on a target. Vergence eye movements allow the eye to focus on the object at various distances. Suppression takes place in saccadic eye movement. While the eyes are rotating to the next fixation they are essentially turned off to prevent a blur of light and images as they move. This downtime has been called saccadic suppression, omission or visual masking.

In Tennis, the player hit the ball in 140mph which is the minimum standard speed for men. So the player needs to change in accommodation as fast as his saccadic eye movements.

There is a synergism between binocular vision, accommodation and vergence. So improving binocular vision improves accommodative facility and anomalies of binocular vision cause anomalies of accommodation. Tennis player improves binocular vision so there is an improvement in the accommodative facility. Our results suggested that there was a significant change in the facility of ocular accommodation between the experienced tennis players and non players.

Trachtman and Kluka (1993) described a web of neurochemical relationship for vision within the whole nervous system. Also, that autonomic nervous system control of accommodation facilitates a link between central and peripheral vision. This connection enables the parallel processing necessary when both central and peripheral vision operate

simultaneously as often they do in sports action. Moreover, they said that relaxation of the accommodative system can expand the peripheral visual field and that accommodation training can bring about changes in color perception as well as improvement in foveal fixation of the object in space.

Sensory, motor, perceptual conditions are more efficient in champions. Specific motor abilities for effective visual search must be considered for any successful player. In sports, the central vision is used to track an object, fixate on an object in space, shift focus from one object to another.

Paul Maman, Shukla Gaurang & Sandhu J. S. concluded that after sufficient vision training there was an improvement in the accommodative facility. And also added that vision training is useful for tennis performance and also boost the performance of other racquet sports as well. The visual system can be trained specifically for different sports along with regular practice which could provide a greater success to the athlete in competition. Accommodation is controlled by an autonomic system and a recent study by Ferrauti et al showed the autonomic system to be more efficient among tennis players.

There was a high statistical change in accommodative facility between experienced tennis players and nonplayers.

Conclusion

There was a high statistical change in accommodative facility between experienced tennis players and nonplayers. This result can be used to detect sports talents and for players with reduced accommodative facility, vision therapy can be used to improve their facility of ocular accommodation. At the end, trainer should be conscious that vision is also a factor which will affect the performance of the player.

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