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Research

Effect of Visual Training on Balance Ability and Peripheral Vision of Volleyball Players

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Abstract:
Since volleyball is a team sport, players must communicate well with one another and work well together to win. It takes skill to lift and hit the ball in a volleyball match. Because of the fast-paced nature of the game and its constantly-evolving scoring structure, volleyball players must possess exceptional agility, coordination, peripheral vision, reaction time, and balancing skills. The purpose of the study was to determine the effect of twelve weeks visual training on balance ability and peripheral vision. Thirty male inter-collegiate level players were selected randomly for this study. Their age ranged from 24 to 27 years. The current study consisted of the Peripheral vision test (Perimetry) and 'Y' balance ability test during pre-test and post-test situations for the Volleyball visual training group. A total of nine training modules were selected by the researcher in consultation with experts in the field of volleyball. The modules were targeted to improve the vision ability and overall performance of selected subjects for the present investigation. A single group pre-test and post-test research design was used in this study to assess the effectiveness of treatment protocol. Tests for normalcy and descriptive statistics were also used in this investigation. Additionally, the paired sample 't' test was applied to investigate the existence of significant difference between pre-test and post-test situations for the Volleyball visual training group. The balance ability and peripheral vision of inter-collegiate level volleyball players significantly improved due to participation in specialized target oriented visual training protocol for twelve weeks used in the present investigation.

Keywords: *Balance ability, Peripheral vision, Inter-collegiate, Visual training, Training protocol and Players.*

1. Introduction

Since volleyball is a team sport, players must communicate well with one another and work well together to win.

It takes skill to lift and hit the ball in a volleyball match. Because of the fast-paced nature of the game and its constantly-evolving scoring structure, volleyball players must possess exceptional agility, coordination, peripheral vision, reaction time, and balancing skills. Since most athletes in achievement sports must be able to run, move, react, or change direction quickly, movement speed is the most crucial skill. (Mawarti, 2021). Around the world, volleyball is a very popular game (Abu-Saleh, 2009). The degree of sports mastery is determined by experience and the development of particular physical and technical skills. Participating in team sports necessitates a sophisticated level of physical, technical, and tactical training (Dana Badau, 2023). Which had been the subject of several studies aiming

at developing the game in terms of performance. Volleyball had a high tempo; it was a dynamic and physical game that didn't have a definite duration and was based on speed, power, dynamism, flexibility, endurance, and jumping (Binboga, 2012). This study attemted to discover whether a visual training program improves peripheral vision and balance ability or not. If the results are as expected and the volleyball training program improves peripheral vision and balance ability, it will aid coaches of volleyball teams in determining players' levels and abilities.

The ability to keep the body's centre of gravity within its base of support is the general definition of balance (Gioftsidou, 2012). The intricate relationship between visual processes and the synchronization of movements with muscular activity is based on maintaining balance (Emery, 2003).

The foundation of all movement is balance. Despite the common misconception that balancing is a static activity, it is actually a highly interconnected, dynamic process involving numerous brain functions. Balance is necessary to maintain bodily posture during an action, during acceleration and deceleration, and during abrupt changes in location and direction. Since balance is a crucial component of all leg actions, it is extremely important (Kadhim, 2023). It made a favourable impact on daily living. Given that immobility is a major issue for children in this age group in the modern world, when physical development is at its most critical, the content and calibre of physical education programs in schools are crucial (Hakan Acar, 2019).

Everything that can be seen to the sides or above without requiring a person to turn their head is considered to be in their peripheral vision, or everything that isn't in their core vision. What a person sees directly in front of them is known as their core vision. The degree of peripheral vision development, visual acuity, and clarity of vision can all significantly influence how effectively team sports-specific technical performance is executed. The lateralization of the cerebral hemispheres has been shown in numerous studies to produce changes in peripheral vision between the right and left eyes. Peripheral vision helps athletes recognize and perceive in depth the movements and forms of objects in space without using their linear attention (Dana Badau, 2023). Peripheral vision and balance are two fundamental components of sports vision. Athletes' perceptual abilities are greatly influenced by both of these elements. The general functions of the human visual system have an impact on peripheral vision (Teresa Zwierko, 2007). Peripheral vision becomes crucial because the visual field's focus is so small, especially in sports. In order to enable motion detection and shift visual attention to other events, peripheral visual information is processed fast. In volleyball, peripheral vision is important because it enables players to react to more game events by being aware of action to the side or above.

The ability to balance and see peripherally depend on the ability of central nervous system to identify a signal and then send a motor command to the muscles (Shejwal, 2020). Sports demand peripheral vision and balance, particularly volleyball, which naturally calls for quickness in learning the field's corners and rapid reflexes when the ball arrives. Athletes can still increase their reaction times through a variety of models and types of exercise, and current training is naturally tailored to the demands of the activity (Mawarti, 2021).

Visual training

A player can be trained to achieve the best level of achievement through training (Haff, 2009). Only with the appropriate training can athletes reach their potential. In order to obtain an advantage in their particular sports and win sovereignty in sporting events, competitive sports managers, coaches, athletes, and scientists have been investigating novel approaches to improve and enhance sports performance (Abernethy and Wood, 2001). The process of receiving data, integrating it with other input, and storing it in the brain is known as vision. A sportsman's ability to use every bit of visual information at his disposal is what makes for an amazing performance. The idea that perceptual competence comes before deliberate and skillful movements in sports has gained traction in recent years (Williams et al., 1999). Like every other component of a player's training program, visual training activities require proper preparation for the competition. In actuality, the visual system functions far better after being loaded or under stress. A visual training program's objectives are to strengthen ocular motor abilities and boost athletic and visual performance (Wilson and Falkel, 2004).

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Understanding what one sees and keeping an eye out for it is called vision. Where one stares determine how well they can see. The coach continues to prepare the entire squad as they grow in awareness of the visual processes and their significance to the athlete (Jayaraja, 2004). Proficiency in volleyball demands the capacity to rapidly and precisely interpret occurrences in intricate sporting environments while maintaining visual focus on the volleyball match. In volleyball, for instance, players interact with other players (opponents and/or teammates) and the playing surface in a constantly shifting, information-rich environment. Among the visually associated skills a player uses during sporting events include accuracy, balance, coordination, and concentration (Wilson and Falkel, 2004). For coaches to understand how vision functions during sports performance and skill training, visual training is crucial (Du Toit et al., 2011). Those with better vision ability and better vision skills show greater ability and confidence in their sport, as detailed in this paper.

2. Objective of the study

The purpose of the study was to determine the effect of twelve weeks visual training on balance ability and peripheral vision of inter-collegiate level male volleyball players.

3. Method and Materials

Subjects

Thirty male inter-collegiate level players were selected randomly for this study. Their age ranged from 24 to 27 years. These subjects were selected from under-graduation and post-graduation programs of Kuvempu university, Shivamogga District, Karnataka. The players had 3.4±0.8 years of experience in participating at inter-collegiate level and other competitive levels.

Criterion measure

The current study consisted of the Peripheral vision test (Perimetry) and 'Y' balance ability test during pre-test and post-test situations for the experimental group.

- **Peripheral vision test *(*Perimetry*)*:** Peripheral vision of right and left eye were measured with a perimetry device purchased specifically for the purpose of the study. In this test, the subjects were asked to sit comfortably in front of the perimeter apparatus an orientation about the perimetry test was given. Tester moved the object slowly and evenly from the edge toward the middle. The subject kept their eyes on the focus point (as in figure 1a and 1b). Tester stopped moving the object when the subject first detected the object. The angle at which subject detected the object was noted. The angle at which the subject detects the object was considered as the score for perimetry test. Reading of both eyes were noted down.

Fig 1a. Picture of perimetry device.

Fig 1b. Pictorial depiction of perimetry testing.

- **'Y' balance ability test:** The 'Y' balance ability test The athlete should be wearing lightweight clothing. After they are required to stand on centre platform, and await further instruction. The test should be performed in the following order (as in figure 2):

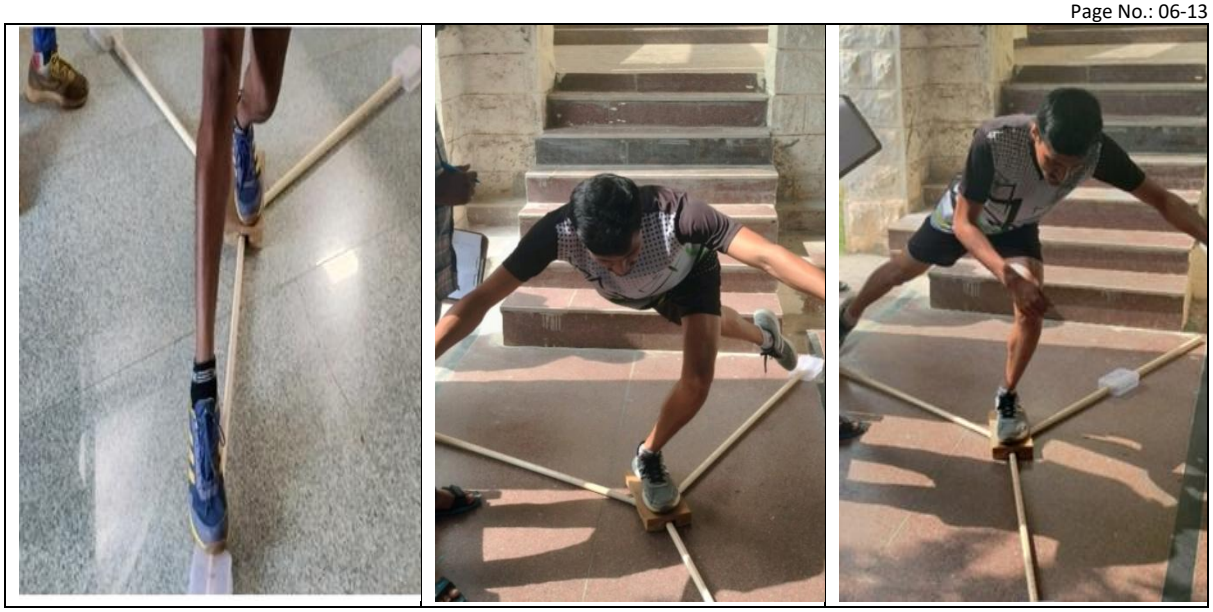

Figure 2: Pictorial depiction of 'Y' balance ability kit used in the study.

- Right Anterior
- Right Posteromedial
- Right Posterolateral
- Left Anterior
- Left Posteromedial
- Left Posterolateral.

The subject stands at the centre of the equipment as in figure 2. The subject should then be instructed to slide the first box forward as far as possible with their right foot and return back to the starting upright position. Reach distances should be recorded to the nearest 0. 5cm. They repeated this with the same foot for a total of 3 successful reaches. After they have completed 3 successful reaches with their right foot, they were then permitted to repeat this process with their left foot. The test administrator recorded the reach distance of each attempt in order to calculate the athletes 'Y' Balance ability test composite score. The 'Y' balance ability test was measured in cm/meter.

Training modules (Vasanthanaik, P., & Prabhu, B. G., 2024)

A total of nine training modules were selected by the researcher in consultation with experts in the field of volleyball. The modules were targeted to improve the vision ability and overall performance of selected subjects for the present investigation.

1. Less luminous (dim light) training: Selected subjects were given training in dim light in the indoor stadium of Kuvempu university. All the lights in the indoor stadium were turned off to create partially dark atmosphere. In this situation the volleyball players had to serve the ball to the opposing team. Subjects in the opponent court received the ball and attacked the set ball to the opponent court. The subjects in the opponent court received the ball and attempted for a counter attack. In this way the ball rallied from one court to another court until the ball became dead. This training need for about twenty minutes in each session. This training aimed to develop subject's reaction ability and functional visual acuity.

2. Varied light training: Varied light training was conducted in Kuvempu university indoor volleyball court. All the lights of the indoor stadium were switched off. Multi-colour lights (Red, green, blue, yellow, and pink) were turned on focused towards eyes of the subjects. Although these coloured lights initially distracted the player's eyes, in this scenario volleyball players must dig the served ball and attack the set ball to the opposing team. In this way training was done for twenty minutes per session. This training module tried to develop the concentration ability and peripheral vision of the volleyball players.

3. Dark-coloured ball training: Kuvempu university indoor volleyball court was utilised for this training. A dark environment was created for low light training by taking a white coloured volleyball and spraying black paint on it. The served dark ball was received and attempted to the set the ball to the opposing team. This training was done for twenty minutes per session. This training aimed at improve depth perception and eye-hand coordination of the subjects.

4. Cover (Tarpaulin) training: This training was given in an outdoor volleyball court. A tarpaulin was

placed above the volleyball net covering entirely. Serve was done from one side of the volleyball court. The subjects on the opponent side received the serve and attempted for attack from their side. The subjects on the receiving side remained alert and attempted for a counter attack. The rally continued till the ball became dead. The peripheral vision, perception and balance ability was attempted to improve through this module.

5. Reaction ball training: A reaction ball was bounced between two players or bounced against a wall and the reaction ball bounced in an unpredictable manner after being pitched. In this case the players also had to catch the reaction ball (as in figure 3) with his efforts. Similarly, subjects put on vision up (pin hole) glasses and catch a reaction ball that bounces against the wall. This training was given for 20 minutes per session.

Figure 3. Pictorial depiction of reaction ball used in the study.

6. Online eye training: Online eye training was conducted through the websitewww.eyebab.com. The vision development training protocol provided in the website was implemented in this study. A computer was required for this study. This training consisted of five levels ranging from easy to difficult. Each step had a starting point and an ending point. Each step comes up on the computer screen as Start. Then arrow mark is shown to help reach from the starting point to the end point. Clicking the mouse on it helped to reach the end point. If the subject commits mistake, the computer displayed the error on the screen. Each subject was allowed to complete five levels at a time. This training improved the peripheral vision, eye sight and reaction time of the subjects.

7. Vision-up (Pinhole) glasses: This training was offered in the indoor and outdoor volleyball court of Kuvempu university. This vision-up or pin-hole glasses had small holes (as in figure 4). Players identified objects in front of them through those small holes. These glassed were put on by two subjects at a time and played upper hand pass and under hand passes. The rally continued for20 minutes per session. This training aimed at improving the hand-eye coordination and peripheral vision of the subjects.

Figure 4. Pictorial depiction of vision-up (pinhole) glasses used in the study.

8. Ceased light training: This training was given inside Kuvempu university indoor volleyball court. The lights are turned off at the time a subjects for spiking an air borne ball set by the setter. This training was given for 20 minutes per session. This training developing the eye-hand coordination of the subjects.

9. Yoga (Trataka):

Jyoti trataka and Jatru Trataka kriyas, related to eye sight improvement were adopted in this training.

A. Jyoti Trataka: Jyoti Trataka is a form of meditation that involves looking at a constant source of light. The subjected seated comfortably and gazed at a candle flame placed approximately arm's length from the eye. The subject sat on the floor with spine comfortably straight. The subject should had gazed slowly into the flame without blinking for as long as is possible. This Jyoti Tratak action was done for 10-15 minutes.

B. Jatru Trataka: This is another form of Trataka called and it is called JatruTrataka. Instead of a candle flame, subjects should stare at the tip of the thumb of the right or left hand while sitting in a comfortable meditation posture this JatruTratak action is done for 10-15 minutes.

Experimental design

A single group pre-test and post-test research design was used in this study to assess the effectiveness of treatment protocol. All the selected subjects were tested twice in the present study. A customized training program to enhance the vision of volleyball players were administered for a duration of twelve weeks.

4. Statistical procedure

Tests for normalcy and descriptive statistics were also used in this investigation. Additionally, the paired sample 't' test was applied to investigate the existence of significant difference between pre-test and post-test score of subjects under investigation.

5. Findings of the study

The raw data of the peripheral vision test and balance ability test in the pre-test and post-test situations of the experimental group were subjected to descriptive statistics and the results are given in Table 1.

Table 1. Descriptive results of peripheral vision test and balance ability test during pre-test and post-test situations of inter-collegiate volleyball players.

Variables	Pre-test and post-test	Mean	Std. Deviation
Peripheral vision test (in angles ^{0})	Right Eye Pre-test	55.68	14.63
	Right Eye Post-test	73.58	13.46
	Left Eye Pre-test	55.61	14.99
	Left Eye Post-test	76.68	16.87
Balance ability test	Right leg Pre-test	1.12	.093
	Right leg Post-test	1.21	.12
	Left leg Pre-test	1.12	.10
	Left leg Post-test	1.21	.13

From above table 1 normality of data is established and the homogeneity of sample is acceptable in terms of standard deviation. It is found that the right eye peripheral vision of pre-test was 55.68±14.63 and post-test was 73.58±13.46; the left eye peripheral vision of pre-test was 55.61±14.99 and post-test was 76.68±16.87; the right leg balance ability of pre-test was 1.12±.093 and post-test was 1.21±.12; the left leg balance ability of pre-test was 1.12±.10 and post-test was 1.21±.13. The data was further subjected to comparative statistics and the results are provided in table 2 as below.

Table 2. Summary of 't' test for differences in peripheral vision and balance ability between pre-test and post-test situations of inter-collegiate volleyball players.

Variables	Test	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Peripheral vision-Right eye	Pre-test and post-test	-4.452	30	.000	-17.90323	4.02128
Peripheral vision-Left eye	Pre-test and post-test	-6.852	30	.000	-21.06452	3.07432
Balance ability Right leg	Pre-test and post-test	-3.138	30	.004	-.09065	.02889
Balance ability Left leg	Pre-test and post-test	-3.380	30	.002	-.09645	.02853

(Significant level is =0.05)

From table 2 it is clear that there is significant difference in peripheral vision of both right (t=-4.452) and left (t=-6.852) eye as well as balance ability right leg (t=-3.138) and left leg (t=-3.380) between pre-test and post-test situations of inter-collegiate volleyball players.

6. Discussion on findings

The present study investigated the effect of twelve weeks of visual training on peripheral vision and balance ability of inter-college level volleyball players. The results of the study revealed that visual training had positive effects on peripheral vision and balance ability of volleyball players. Visual training leads to improvement in volleyball players in particular. Based on this result, continuous vision training can help improve hand-eye coordination, peripheral vision, reaction time, concentration ability, balance ability, and perform well in volleyball. Volleyball players, coaches, and trainers should incorporate vision training into their training regimens to improve performance in volleyball. The results given by some researchers regarding this study are complementary. Daniel Culberer (2017) attempted to investigate visual differences between professional athletes in the National Football League. Our study found that players of all positions have similar peripheral awareness and eye-hand coordination abilities. Players in skilled positions

showed faster visual reaction times. Toby C.T. Mak, et al, (2021) was to investigate whether visual-related interventions are effective in improving balance and walking ability in healthy older adults. The results indicated that visual-related training generally led to improvements in balance and walking ability in healthy older adults. Rameshpandian and Rajeswaran (2021) identified the effect of visual skills training on select visual skills of depth perception and ability of static and dynamic balance among the badminton players at school level. The results of the study confirmed the effect of visual skills training positively on visual abilities of depth perception and ability of balance such as static and dynamic.

7. Conclusion

The balance ability and peripheral vision of inter-collegiate level volleyball players significantly improved due to participation in specialized target oriented visual training protocol for twelve weeks used in the present investigation.

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