

# Protocol for Systematic Review - Association of Visual Performance with Sports Performance in Badminton

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**Abstract:** ***Background:** Visual skills are the basic skills of the visual system include all types of eye movements which help the image to locate on fovea. These visual skills play an important role in sports performance. The use of these skills varies according to the environmental demands associated with that particular sport. These environmental demands are matched by a task specific motor response. The athletes undergo the complete visual function assessment as part of their overall developmental program irrespective of the sport that has impact on performance. If trained properly, it can have positive impact on performance of sport. Hence our review aims at to find the association between the visual skills with respect to badminton. **Methods:** This protocol is for systematic review comprehensive search for the literature will be done using various key words in PubMed/MEDLINE, Scopus/Embase, Cumulative Index to Nursing and Allied Health Literature (CINHAL), Cochrane, ProQuest, Web of Science All titles and abstracts will independently be screened by two reviewers to assess which studies meet the inclusion criteria., and conflict on the inclusion will be resolved by a third reviewer of the research team. Following which we will retrieve the full text copies of all potentially relevant papers. Presentation of all the results will be based on Preferred Reporting Items for Systematic Reviews and Meta analysis statement.*

**Keywords:** Badminton, visual function, eye-hand coordination, dynamic visual acuity, ocular dominance

## 1. Introduction

Visual system is one of the most crucial part in the human body, vision or visual skill is the primary important sensory parameter (1). Vision contributes to about 80% of sensory information and therefore it plays important role in most of human activities, especially in sports. (2-9).

Visual skills are the basic skills of the visual system. It includes all types of Eye Movements, which helps the image to locate on fovea. These skills, important for tracking moving object or looking from one to another object as well to focus on a single object. Eye Teaming, which refers both the eyes are pointing at a same object at the same point. There can be disorientation in processing and confusion without this ability for meaningful response. Focusing is the ability to see clearly at any distance for any period of time maintaining minimal but active accommodation efforts. Other important aspects of visual function are eye/hand coordination, peripheral visual awareness, and many more. (10)

These visual skills play an important role in performing sport skills. The use of skills associated with particular sports varies according to the environmental demands of the sport. These particular sport environmental demands are matched by a task specific motor response. (2, 11, 12)

Visual performance in sport can be seen as an interaction between two components of visual system namely the hardware (the eye and visual pathway) and the software of visual system in visual cortex. Hardware Visual system refers to the general abilities that are underpinned by the mechanical and biological aspects of the visual system and would include visual acuity, visual field size, and depth perception, contrast sensitivity and accommodation etc. Software visual system, on the other side, are more

associated with cognitive aspects of the visual system, is often more specific to the activity at hand, and thus correspond to skills such as visual search strategies, anticipation, visual attention and memory, and reaction time. (13)

The Fundamental sensory information needed during competitive sporting actions is provided by the visual system. About 95% of all physical activities are controlled by visual contributions and that this is the prompt mechanism for the first movement of the athlete (14, 15). Athletes need to gather a great amount of information, mainly visual, swiftly from the environment in order to execute appropriate motor tasks. (16) The comparison of visual parameters like, positive fusional vergence for far and near, facility of accommodation, accommodative response and static far and near stereo acuity. Athletes have demonstrated superior visual ability, hand eye coordination and reaction time compared to non-athletes. (7, 9, 12, 16)

Vision is the most foremost sense, with 70% of all sensory receptors in the eye. Vision, with components such as visual skills, contributes up to 80% of information obtained from environment around us (14, 15). The importance of vision and related processes in sport has long been explored. For the same reason athletes are required to undergo the complete visual function assessment as part of their overall developmental program irrespective of the sport. This will have impact on the athlete performance. If trained properly, it can have positive impact on performance of sport. (14) Many studies have evaluated relationship between visual skills and athlete's performance. There are good number of studies that have assessed this relationship and also methods to enhance visual skills for superior sports performance. A systematic review of these studies is required to determine relationship of visual skills with sport performance.

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For the purpose of study, Sports are classified in different categories and each category demands specific visual skills. (2, 3) some visual functions are crucial while some are least required based on nature of activities of particular sport. The list varies from one sport to other; therefore it is essential to determine the list of necessary skills specific to the particular sport. It will also help in training of athletes, specifically to attain improvement and consistency in performance. (3, 12, 14, 17–21) This review attempts to find the important visual functions required for better performance in badminton

This review will reveal vital information regarding importance of visual function assessment in badminton players, its impact on the performance, and can suggest training of specific visual skills for badminton sport.

## 2. Objectives

- 1) To find out the all visual skill requirements that play critical role in badminton performance.
- 2) To find the effectiveness of the training program to improve those visual skills

## 3. Research Question

After reading this review the reader will have knowledge of the following:

- The important visual skills for Badminton performance.
- List of most important visual functions required to be assessed in badminton activity
- Role of training programs to enhance those visual functions for superior performance in the field

## 4. Methods

This systematic review is based on guidelines of the Preferred Reporting Items for systematic Reviews and Meta-Analysis (PRISMA) (22) and the protocol of Systematic review is registered with the International Prospective Register of Systematic Reviews (PROSPERO). (Reg. no. CRD42018090184)

Comprehensive search for the literature will be done using various key words in different databases and the Articles will be selected on the criteria's discussed in the protocol.

In the reference management database all the titles and abstracts obtained in the search results will be included. Duplicates will be removed. All the titles and abstracts will be screened independently by two review authors to assess which studies meet the inclusion criteria and conflict on the inclusion will be resolved by a third reviewer of the research team. Following which full text copies of all potentially relevant papers we will be retrieved.

## 5. Criteria for Considering Studies

### Criteria for Study Inclusion

This review will include all the articles peer reviewed and published in the electronic database that describes the study of badminton and its relationship with the visual functions.

### Study Design:

All quantitative, qualitative and mixed methods approaches are eligible for inclusion, to obtain the comprehensive data from the existing evidence. This may include the Randomized Controlled Trial or Cohort Study (Prospective Observational Study) or Case-control Study or Cross-sectional study without any restrictions. All relevant articles will be considered for the overview of all the available evidence on badminton and visual function.

### Participants:

All players regardless of age groups, racial, location, gender, ethnic, culture or religious group and level of competition will be eligible for inclusion.

### Outcome Measures:

Studies will be included if they have assessed any outcome of visual functions with respect to badminton. Based principally on the need to address the research questions, the main outcomes for the systematic review considered to be Visual functions (or visual skills) used for badminton sport.

### Exclusion Criteria:

The studies are excluded merely on: (1) studies available in any language other than English (2) published in books or grey literature, conference abstracts, (3) studies with insufficient and/or inappropriate quality (4) studies that have incomplete results and conclusion Further, studies on Para Olympic athletes, specially abled athletes and assessing ocular trauma, head trauma, sport related injuries or its risks and neurological disorders will be excluded.

## 6. Search Strategy

### Search Resources

The following databases will be searched: PubMed/MEDLINE, Scopus/Embase, Cumulative Index to Nursing and Allied Health Literature (CINHAL), Cochrane, ProQuest, Web of Science. Two independent reviewers from the team will search all above databases, with a gap of one week between searches and the search is completed during 1<sup>st</sup> March 2018 to 15<sup>th</sup> March 2018.

**Keywords:** Following the PICO strategy, following keywords were selected for the search.

“VISUAL FUNCTION\*” OR “VISUAL SENSITIVITY” OR “VISUAL SKILL\*” OR “VISUAL ABILITY” OR “VISUAL ELEMENT\*” OR “OCULAR FUNCTION\*” OR “VISUAL ACUITY” OR “VISION” OR “VISUAL RESOLUTION” OR “REFRACTIVE ERROR” OR “STATIC ACUITY” OR “DYNAMIC ACUITY” OR “KINETIC ACUITY” OR “CONTRAST SENSITIVITY” OR “COLOR VISION” OR “DEPTH PERCEPTION” OR “DEPTH DISCRIMINATION” OR “DEPTH JUDGMENT” OR “CONTRAST ACUITY” OR “STREOPSIS” OR “STEREO ACUITY” OR “PERCEPTION OF DEPTH” OR

“VERNIER ACUITY” OR “CONTRAST THRESHOLD” OR “BINOCULAR VERGENCE” OR “OCULAR MOVEMENTS” OR “OCULAR ALIGNMENT” OR “EYE MOVEMENTS” OR “PURSUITS” OR “SACCADES” OR “OCULAR MOTOR FUNCTION” OR “PHORIA” OR “TROPIC” OR “ACCOMODATIVE TRIADE” OR “CONVERGENCE” OR “AC/A RATIO” OR “ACCOMMODATION” OR “CONVERGENCE” OR “DIVERGENCE” OR “DEPTH OF FOCUS” OR “DEPTH OF FIELD” OR “HAND EYE COORDINATION” OR “EYE FOOT COORDINATION” OR “HAND PREFERENCE” OR “BODY EYE COORDINATION” OR “EYE DOMINANCE” OR “OCULAR DOMINANCE” OR “EYE PREFERENCE” OR “OCULAR PREFERENCE” OR “OCULAR HEALTH” OR “EYE HEALTH” OR “PERIPHERAL AWARENESS” OR “PERIPHERAL VISION” OR “FIELD OF VIEW” OR “FIELD OF VISION” OR “VISUAL FIELD” OR “PERIPHERAL VISUAL FIELD” OR “PERIPHERAL ACUITY” OR “GAZE ANGLES” OR “VISUAL ANGLE” OR “ANGLE KAPPA” OR “VISION REACTION TIME” OR “VISUAL MOTOR REACTION TIME” OR “MOTOR RESPONSE TIME” OR “ANTICIPATION TIME” OR “SPEED OF RECOGNITION” OR “VISUAL MEMORY” OR “VISUAL TIME” OR “VISUAL COINCIDENCE” OR “VISUAL TRIADE” OR “VISUAL CALISTHENICS” OR “BODY BALANCE” OR “VESTIBULO OCULAR REFLEX” OR “VISUALIZATION” OR “IMAGERY” OR “VISUAL ATTENTION” OR “VISUAL STRESS” OR “VISION THERAPY” OR “VISUAL TRAINING” OR “VISUAL SKILL\* TRAINING” OR “VISION TRAINING” OR “SPATIAL LOCALIZATION” OR “DIRECTIONAL LOCALIZATION” OR “VISUAL PERCEPTION” OR “VISUAL FIELD DEPENDENCE” OR “VISUAL FIELD INDEPENDENCE” AND “BADMINTON” OR “BATTLEDORE” OR “SHUTTLECOCK” OR “RACQUET SPORTS”

## 7. Data Extraction (Selection and Coding)

### Level 1: Article Screening

The first level of article screening will examine the article title only. Two blinded reviewers will review all resulting article titles. Only articles that are clearly unrelated to the research questions will be removed at this level. If any doubt exists on the relevance of an article title, it will be included in the abstract review.

### Level 2: Abstract Review.

The abstracts of all articles included from Level 1 will be reviewed by two independent reviewers. Any conflicting results between the two reviewers will be resolved by third reviewer. The decision of third Reviewer is considered as final.

### Level 3: Full Text Review.

All records selected from Level 2 will be reviewed with full text. The full text of all articles included from Level 2 will be reviewed by two independent and masked researchers. The two reviewers will collate results, and will report findings to the third reviewer. Any conflicting results between the two reviewers will be resolved by Third Reviewer who makes the final decision

### Level 4: Reference List Search.

The reference list of each selected article will be fully reviewed to ensure that no relevant articles will be overlooked.

### Level 5: Expert Review.

The entire process of screening titles, abstract and full text articles and also quality appraisal will be mentored by an expert from the field of sports (Badminton).

### Data Extraction:

Data from the final full-text articles after ensuring quality of evidence will be extracted by two independent and blinded reviewers. Any conflicting results between the two reviewers will be resolved by Third Reviewer who makes the final decision.

**Data to be extracted:** Data extraction will be done using excel sheet with following entries

General information about Title of the article, main author, publication Year will be documented. Then study related data which includes study design and sample Size will be considered. Further, athlete related data, level of participation, Age (mean, SD; range), Sex (% men and % women), and any other Specific Population Characteristics (if any) will be documented. Most importantly, visual characteristics data which includes visual skill measured, training used for improvement of a particular skill, and benefits of visual training in badminton performance of athlete will be considered for the analysis.

### Risk of Bias (Quality) Assessment

The quality of the articles included in full-text review will be assessed by using critical appraisal tools and AMSTAR guidelines.

### Strategy for Data Synthesis

Qualitative data will be synthesized using qualitative data software. The results will collated from the data extraction using excel sheet.

### Analysis of Subgroups or Subsets

Based on extracted data, various visual functions will be grouped based on its nature and clinical measurement. Then qualitative synthesis will be performed.

## 8. Discussion

The review will discuss about importance of different visual skills in performance of badminton. It will also discuss on various training programs that focus on improving visual skills of athlete that will enhance badminton performance. The conclusion will be drawn based on current available evidence about the important visual skills and nurturing them through an effective training program for improvement in badminton performance of an athlete.

## 9. Conflict of Interest

Nil

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