When 20/20 Vision Isn’t Enough
By Michael Reed, O.D.

At some point in your life you have probably heard the saying, “keep your eyes on the ball.” This concept seems simple enough. If you can see those tiny letters in the exam room, this should be no problem at all. In fact, having good vision, such as 20/20 or better, is only part of the equation when it comes to playing sports. Athletes not only have to be physically fit, but visually fit as well. Almost every sport requires the athlete to use his or her vision in a multitude of ways in order to successfully play the game. This is called sports vision.

This article will start with exploring the concept of sports vision a little deeper. When any athlete steps onto the playing field, the tasks involved will vary depending on the type of sport and position (if applicable) the person plays. The type of visual skills needed for a sport will also vary for the same reasons. The most common skills used include: depth perception, dynamic visual acuity, static visual acuity, visual attention, balance, contrast sensitivity, spatial localization, eye-hand-body coordination, peripheral vision and imagery. The following are explanations of each of these skills:

**Depth perception**: the ability to see an object in three dimensions

**Dynamic visual acuity**: how well a moving object is seen

**Static visual acuity**: how well a non-moving object is seen

**Visual attention**: focusing attention on a person or object through the use of sight

**Balance**: body stability

**Contrast sensitivity**: discerning any object from a background (i.e., a white ball against a blue sky)

**Spatial localization**: identifying where an object is in space in relation to you or another object (i.e., judging how far away you are from another player)

**Eye-hand-body coordination**: using vision to recognize what you need your body to do, then having your body react the way you intended.

**Peripheral vision**: commonly referred to as “side vision”
**Imagery**: mentally visualizing a task (i.e., imagining hitting a home run).

Let’s use baseball as an example of how some of these skills are used. If a pitcher throws a 90-mph fastball, the batter has a little less than half a second to decide what type of pitch it may be, determine how fast the ball is traveling and swing the bat before the ball crosses home plate. In order to successfully hit the ball, the batter needs good depth perception to determine its speed, accurate eye movements to track its movement and good eye-hand coordination to put the bat in the right spot. A batter attempting to “read the seams” has to have excellent dynamic visual acuity, meaning he or she has to be able to clearly see an object while it is in motion, like the baseball. This is much harder to do than looking at something that is not in motion, like those all too familiar eye chart letters. All the while, the player has to maintain good balance, which is heavily influenced by vision. Just to prove this point, try standing on one foot with your eyes open, then with your eyes closed. Which way was easier? Another skill batters must use is spatial localization. If they tend to see an object, like the baseball, as being a bit closer than it really is, they will have a tendency to swing the bat too early and knock the ball into left field without intending to do this. If they tend to see objects as being further away than they really are, they will swing late and knock them into right field. Sounds odd, but it really happens. One final example of how vision is used in this situation is visual attention. As mentioned, this refers to using your eyes to shift or focus your attention on a person or object. Athletes may be able to focus their attention on something with no problem if there are no distractions, but what happens when you add in a yelling coach or parent, or increased crowd noise? It becomes much harder to focus on what you are seeing or concentrating on. A person’s field of attention shrinks. This makes hitting the ball or accurately pitching the ball much harder for those not able to block out the things causing stress.

Keep in mind baseball is not the only sport that places visual demands on an athlete. Football, softball, basketball, soccer, golf, tennis, archery and almost every other sport you can think of requires the use of several different visual skills. Athletic performance can be affected if the player is not able to efficiently use these skills or if they are not being used to their full potential. Fortunately, the majority of the skills used are trainable. This is because most of them are not controlled by the anatomy of the eye and related musculature, but instead by the brain.

Sports vision is an area of optometry that is specifically focused on helping athletes with the visual demands of their particular sport. An examination, given by an optometrist trained in sports vision, includes tests that measure the athlete’s visual abilities. The purpose for the examination is to identify problem areas, as well as areas that are not being used at maximum potential. Both of these situations would inhibit the athlete’s success. Of course, vision is not the only factor involved with sports performance. The visual skills of an athlete can be maximized, but they may still have performance problems. It must be made clear to the patient that having maximum visual ability does not guarantee professional-level performance.

The exam starts with a thorough case history. Useful information includes: what sports the patient plays, any problems related to vision, patients’ concerns about vision inhibiting their sports performance, whether the patient had a complete eye examination
in the past year, if the patient currently wears glasses or contacts, etc. It is important that the patient has had a dilated exam to rule out any ocular disease. Here are some of the tests performed during a sports vision examination:

**Static visual acuity:** measured typically with a Snellen chart

**Dynamic visual acuity:** may be measured with a device that rotates letters or numbers while the patient attempts to read them. The speed of rotation and size of the letters can be adjusted.

**Cover test:** determines if the patient has strabismus or a significant phoria. A phoria is the tendency of the eyes to focus behind or in front of an object. This can lead to visual stress and poor spatial localization. It may be tested in different gazes. For example, if a basketball player has problems with free throws, he or she may have a significant upgaze problem, which could show up with cover testing.

**Oculomotor testing:** this tests the ability of the patient’s eyes to look back and forth from object to object and to follow a moving target.

**Depth perception (stereopsis):** usually tested under binocular conditions, although some test monocular depth perception. True stereopsis is only achieved binocularly, but how far away something is from you can somewhat be determined by “monocular clues,” such as shadow changes and changes to the size of the object. An instrument is available to test monocular depth perception.

**Contrast sensitivity:** some instruments will test the ability to detect an object against a background at different lighting levels.

**Accommodative testing:** determines how accurately the eyes “focus” on an object, as well as the ability to focus when switching back and forth between objects at different distances.

**Color vision:** abnormalities may affect performance in some sports.

Other tests may be performed at the doctor’s discretion. Not all tests give a measurable finding; some require only observation about the patient’s responses or physical posture during testing.

Testing does not always have to be performed in-office. The doctor may choose to organize a screening for a team. Some equipment may be taken to a school gym or other location closer to where the team meets in attempts to minimize traffic through a clinic or accommodate the requests of the players. The doctor may also choose to sit in on a practice either before or after the screening in order to monitor the players’ performance. Once the testing is complete, the doctor can present some suggestions on how to improve the team’s overall performance by pointing out the visual strengths and weaknesses observed.
Once it has been determined a problem exists or skills can be improved, a treatment plan is created. This may involve prescribing glasses or contacts, tinted lenses, or a vision therapy program. If a vision therapy program is prescribed, the doctor formulates a plan involving therapy sessions focusing on that particular patient’s needs. This is much like physical therapy for the eyes. At each session, the patient is engaged in visual training exercises. The types of exercises used depend on the overall needs of the patient. There are three phases to this type of therapy. The first phase is focused toward resolving any visual problems, such as inaccurate eye movements. Once the problem areas are fixed, all the skills used by the patient are worked on in order to reach maximum potential. Finally, stress is introduced into the sessions. For example, the doctor may have the patient walk on a balance beam while having to catch beanbags being thrown at him or her with loud music playing. This not only teaches the patient how to perform tasks while under pressure, but also helps to combine visual skills so that the patient is able to seamlessly perform them without effort. The doctor may do progress checks at various points throughout the program to ensure the player is on track. Once the program has been completed, the doctor may also schedule another progress check some time in the future to make sure the patient is retaining the skills that were trained.

Hopefully this article has given you a better understanding and appreciation of the complex relationship between sports and vision. Sports vision is for athletes of all ages and levels, even the pros. So next time you’re out on the field or just in your backyard, don’t forget to “keep your eye on the ball!”

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When 20/20 Vision isn’t Enough Quiz

To receive one hour of continuing education credit, you must be an AOA Associate member and answer seven of the ten questions successfully. This exam consists of multiple-choice questions designed to measure your level of understanding of the material covered in the continuing education article “When 20/20 Vision Isn’t Enough.”

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Select the option that best answers the question.

1.) Which of the following is the definition for dynamic visual acuity?
   a. commonly referred to as “side vision”
   b. how well a moving object is seen
   c. how well a non-moving object is seen
   d. the ability to see an object in three dimensions

2.) As a treatment plan for vision weaknesses, the doctor may prescribe all of the following except:
   a. glasses or contacts
   b. tinted lenses
   c. vision therapy program
   d. Proparacaine - twice a day

3.) Which of the following tests is not included in a sports vision exam?
   a. fundus photography
   b. oculomotor testing
   c. dynamic visual acuity
   d. static visual acuity

4.) Which of the following describes contrast sensitivity?
   a. being able to tell where you are in relation to another person or object
   b. mentally visualizing a task
   c. stability of the body
   d. discerning any object from its background
5.) The first phase of the therapy program is designed to...
   a. resolve any visual skill problems
   b. enhance to a maximum level
   c. add stress
   d. make the problems worse

6.) This is commonly referred to as “side vision”
   a. contrast sensitivity
   b. spatial localization
   c. peripheral vision
   d. stereopsis

7.) Which term refers to mentally visualizing a task?
   a. static visual acuity
   b. stereopsis
   c. imagery
   d. balance

8.) Which of the following is tested with a Snellen chart (not moving)?
   a. dynamic visual acuity
   b. static visual acuity
   c. color vision
   d. imagery

9.) The sports vision exam starts with which of the following?
   a. cover test
   b. case history
   c. accommodative testing
   d. oculomotor testing

10.) Which of the following determines if a patient has strabismus or a phoria?
    a. cover test
    b. color vision testing
    c. reading from a rotating chart
    d. asking if the patient wears colored contact lenses