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BASICS OF

COMPUTER VISION SYNDROME

Ajay Kumar Bhootra

2nd Edition

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CHAPTER 4

Understanding Patient, Patient's Visual Environment, and Visual System

Today, this is an established fact that an effective communication is essential between the patient and the practitioner. The immediate advantage is seen as to improved diagnosis and outcomes, treatment adherence, and patient satisfaction. However, there are challenges from both the sides. Patients come from diverse cultural and ethnic backgrounds and are differently influenced by individual factors related to the psychological and socioeconomic conditions that impact their behavioral responses. On the other hand, the practitioners also try to substitute face-to-face history taking with an intention to minimize time engagement with the patient. This leads to create a strong barrier between them. We need to accept that every patient is unique. He lives in his unique conditions that impact his health. Hence, it is necessary to be familiar with the person and his visual environment before embarking upon the clinical examination procedure. This is especially very important for patients complaining of symptoms of computer vision syndrome (CVS). A patient with symptoms of CVS visits the optometrists; he expects to get the treatment for ocular and/or visual-related difficulties. He may not be very keen in sharing any other symptoms that may not be related directly to vision or visual system, but it may be important for diagnosis. It is, therefore, important to establish a platform where the patient is encouraged to communicate all his symptoms in details and the visual environment in which he works and other related factors. With detailed information about the patient and the status of his vision and visual system, the practitioner can proceed and design an effective treatment plan in which the patient is also involved. The straightforward meaning is that the clinical examination procedure for a patient complaining of symptoms of CVS should start with:

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- History taking
- Visual acuity test
- Dominant eye test
- Objective assessment of eyes.

HISTORY TAKING

History taking **(Fig. 4.1)** forms the basic foundation for all medical examination. A well-taken history may lead to make correct diagnosis. The basis of true history taking is good and direct communication between the patient and the practitioner. Sometimes, printed formats are used to expedite the process, but they do not provide the answers to many questions that are obtained through direct observation or interaction with the patient. More importantly, face-to-face contact begins to establish a meaningful patient-practitioner relationship. The patient may begin to relax and feel more confident when he sees that the doctor is taking the time to listen to his complaints. History-taking is an art during which barriers between the patient and the practitioner are broken and a kind of trust is built up and at the end the patient starts taking the practitioner's advice. It is not only important to elicit the critical points of health issues, but it is equally important to demonstrate your expertise. The practitioner also explains the significance of different testing procedures which will follow to elicit his cooperation in forthcoming procedures.



Fig. 4.1: History taking.

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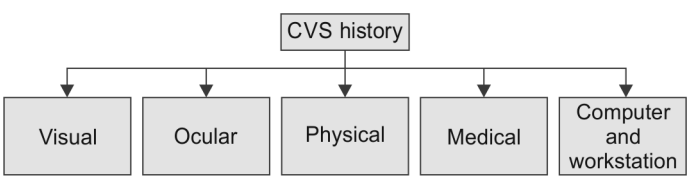
History taking also means involving the patient so that he understands his own conditions and better cooperates in the management process. However, the value of the history taking depends upon the ability of the clinician to elicit the relevant information. The sense of what constitutes important information grows with the experience. In most cases, a comprehensive history taking for CVS patients must include what is shown in **Flowchart 4.1**. It requires an ability to listen and apply common sense to define the nature of a particular problem. Extensive history taking is very critical in the successful treatment plan of the patients reporting with the symptoms of CVS. The computer operator needs to understand that visual assessment cannot make things to take a miraculous change, but the potential for improvement is enormous. At the outset, it is usually best to let the patient relate the course of his visual changes and other difficulties and the practitioner should listen without any interruption. This relaxes the patient and he understands that you are interested in the history. Such an understanding at this level sets the tone and encourages support from the patient who relates his own problems to the visual requirements. The proceeding may continue with detailed questioning. The first important issue is to establish the reason for the visit. The practitioner may straightaway ask the patient the reasons for visit and then enquire about his occupations and general lifestyle. With this information, he may proceed to get detailed history about ocular and visual conditions. The following vision-related information is important:

- Do you wear any glasses or contact lenses?
- When was the last eye examination done?
- What was the change in the glass prescription?
- How frequently do your lens power changes?

Flowchart 4.1: Comprehensive CVS history taking.



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- Do you feel any difficulty in seeing distance after prolonged use of computer?
- Do you see double image?
- Do you frequently lose place when moving eyes between copy and the screen?
- Do you squint while working on computer?
- Do you see any changes in color perception?

In addition, you may ask questions that are related to dry eyes, for example, presence of dryness in eyes, irritated eyes, and foreign-body sensation. History of past eye treatment or surgery is also important. With this information, the practitioner may set to ask questions related to general health such as neck pain, shoulder pain, back pain, muscles ache, wrist and finger stiffness, and headache during or after computer work that will straightaway direct toward the diagnosis. In addition, information about hypertension and diabetes and intake of antidepressant drugs are important to note. The history is so taken enough to direct you to diagnosis, and hence you may complete the process of history taking with the following set of questions:

- Placement of computer monitor
- Working distance and viewing angle
- Types of chair—with footrest, without footrest, handle, and back support
- Types of room—lighting and their arrangement
- Room paint types—matt, glossy, plain, or with stripes
- Location of window
- Tabletop—glass, wooden, matt, or shining
- Approximate duration of time spent on computer
- Types of monitor used
- Size and form of screen characters
- Screen color
- Contrast and brightness of monitor

All information so elicited must be recorded on a standardized form and should be used to relate to clinical signs. It is also advised not to spend too long time taking history as it may lead to the patient getting frustrated and the patient stands unsatisfied right at the beginning.

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VISUAL ACUITY TEST

Visual acuity is the fundamental characteristic of the visual system and is the prime determinant of any regime that aims to improve visual and therefore occupational performance. It is the time-dependent measurement of retinal health and is specified by date and time on which assessment took place. Visual acuity needs to be recorded in three states of condition as shown in **Flowchart 4.2**.

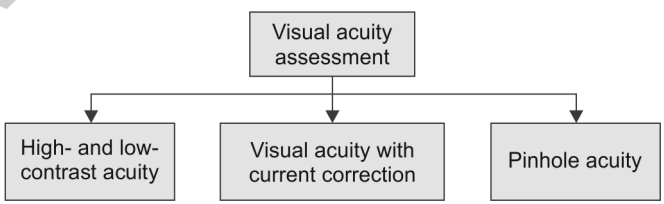
High- and Low-Contrast Acuity

High- and low-contrast acuity measurements are important measurements to understand the insights of the visual system. High-contrast acuity measurement becomes a benchmark against which the benefits of using refractive correction may be referred. Low-contrast acuity is more likely to elicit a visual deficiency. Low-contrast acuity test is the useful tool in the early detection of various diseases as well as in the determination of any complications. Two persons with similar acuity can function differently that may be predicted by differentiating between high- and low-contrast acuity. In general, a poor performance with low-contrast acuity points toward the need for more attention to glare control, contrast of viewing targets, and the illumination.

Visual Acuity with Current Correction

A well-taken visual acuity measurement is critical to ensuring an accurate spectacle correction—just right ... not too strong ... and not too weak. This implies that the examiner is looking for the finest detail that the visual system can resolve. Measuring the visual acuity with the existing correction reveals information as to the possibilities of any improvements. Many times, the patient carries a perception that his

Flowchart 4.2: Visual acuity tests.



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acuity is better with his old correction than the new one. Recording the acuity with old correction provides an opportunity to compare with the new correction and is also a strong indicator on which the subjective refraction may be initiated.

Pinhole Acuity

Pinhole acuity is critical to determine whether the decreased visual acuity is correctable by lenses or not. It reduces the size of the blur circle that has been created on the retina by an uncorrected refractive error that establishes that better visual acuity may be achieved with refraction. However, for most CVS patients, this may not be very important, but it is certainly helpful for differential diagnosis.

DOMINANT EYE TEST

Something happens—that is one thing. Why it happens and what it amounts to, these are entirely different things. People easily misinterpret knowingly or unknowingly just because the implication of a concept is not clear and well established.

The phenomenon of "dominant eye" probably falls in this category. The concept has been known for several years, but its implications are still not very clear. We all know that most people are born with a dominant tendency to use one eye more than the other even if the vision in both eyes is perfect. In the binocular vision system, one eye leads in fixating at the target and the other follows the leading eye. There is a small time lag between the two eyes fixating at the same target that allows the required depth perception. The phenomenon suggests that the leading eye is sighting first toward the target and, therefore, it may be considered as sighting dominant eye, the other being the nondominant eye. Thus, eye dominancy refers to the superiority of one eye over the other in terms of receiving the visual inputs. It contributes most to the visual perception. It is easier in general to suppress the nondominant eye. For example, while lining up two objects one relies on the dominant eye even if the nondominant eye is also open. Some patients are uncomfortable if their dominant eye is fractionally blurred or over plus by 0.25 Dsph relative to the other eye. On the other hand, a small uncorrected or residual refractive error in the nondominant eye may possibly not give

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any discomfort. Law 1 of "laws of computer vision" says that fixation is the primary visual ability for the person working on a computer. If the fixating eye is not adequately corrected, it may lose its place and may wander leading to loss of place. Knowing the sighted dominant eye is, therefore, critical to the tasks where visual demands are at peak. Establishing which eye is dominant plays a vital role in binocular vision assessment. It may help us to design a better visual behavioral pattern. For example, for people working more on computer, the location of the visual target plays a major role in determining sitting posture. Visual requirements result in the user positioning the body so that the face is parallel to the viewing surface. This principle should be remembered when determining placement of the monitor and allied attachments. Document holders are generally placed to the side of or in front of the monitor. When placing the document holder to the side of the monitor, the dominant eye should be considered. Favoring the dominant eye with the most frequently used visual targets may require less eye, head, neck, and body movement to view these targets. This is due to the fact that the center of the visual field is closer to the dominant eye than the nondominant eye. A left-eye-dominant person should position frequently viewed documents to the left of the monitor.

The majority of the population is right-eye-dominant; some are left-eye-dominant also. A small number of people also show no definite ocular dominancy. Eye dominancy is believed to be congenital, showing a consistent preference from the early infancy. Although both eyes are used to judge the distance, it is the alignment of the usually dominant eye and the target that gives the direction. It implies that eye dominancy is an important phenomenon for highly visually demanding tasks.

There are various methods to assess eye dominance. The "hole in the card test" **(Fig. 4.2)** is the simplest among them. The subject is given a card with a small hole of 25 mm in the middle and is instructed to hold it with both hands stretched out. He is then instructed to view a distant object through the hole with both eyes open. If binocular vision is present, he tends to center the hole between his eyes. The observer then observes his eyes through the hole by alternately closing his eyes. The eye is seen through the hole which would be the dominant eye of the person.

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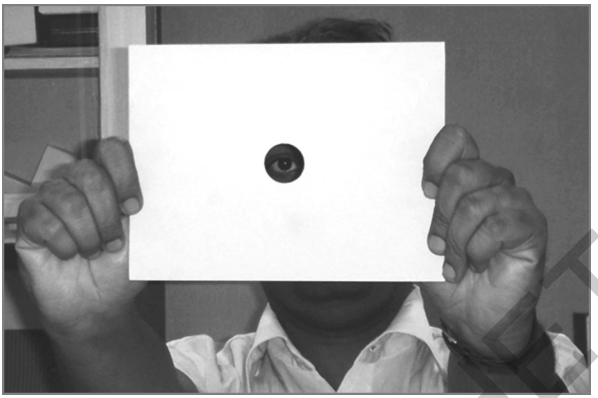

Fig. 4.2: Hole in the card test.

Alternatively, the observer may ask the patient to slowly draw the opening back to the head to determine which eye is viewing the object. Invariably, the patient will take the hole toward his dominant eye.

OBJECTIVE ASSESSMENT OF EYE

Objective assessment of eye gives a good starting point to the practitioner on which the practitioner can set the platform for the comprehensive eye examination. The practitioner performs the gross observation of the anterior structures of the eyes and determines the refractive error without taking any input from the patient and thus establishes a baseline idea to carry out the subjective refraction. Several tests form the part of the objective assessment of the eyes. The common tests that may be applied for patients complaining of symptoms related to CVS are shown in **Flowchart 4.3**.

Torchlight Examination

Torchlight is a wonderful tool to carry out the gross examination of the anterior segment of the eye. It is a very effective tool to detect distinct abnormalities and can be very effective in differential diagnosis. Pen light is commonly used for the purpose.

A direct focusing of pen light or asking the patient to fixate at the pen light helps detecting strabismus by the Hirschberg corneal light reflex. You just need to examine the exact location of the bright light

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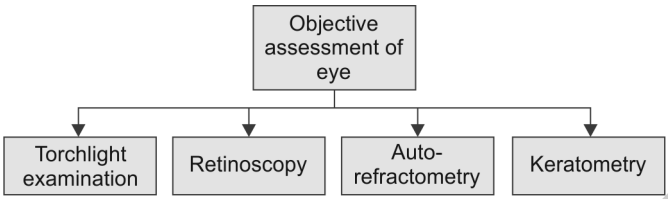
Flowchart 4.3: Tests for objective assessment of eye.



reflex on the cornea near the center of the pupil and compare both eyes. In normal eyes, when the eyes are looking straight ahead, the Hirschberg reflex will be seen at the same position of both eyes, i.e., 5° toward nasally. Esotrope will show reflex toward the ear away from nose.

Pupil shape, size, and reactivity to light can be examined with pen light. Under normal illumination, the normal pupil size is 3–4 mm. Both eyes' pupils are of the same shape and size. Pupillary light reflex test also provides useful information about the integrity of the sensory and motor functions of the eye. Under normal condition, pupils of both eyes respond identically to a light stimulus, regardless of which eye is being stimulated. Both pupils should constrict with light shone onto either eye alone. If light is being shone on the right pupil, the response seen in the right eye is direct response and the response seen in the left eye is consensual response. Direct response in the right eye without a consensual response in the left eye implies a problem with the motor connection to the left eye. Lack of direct response implies a problem with sensory inputs from the right eye.

A gross idea of anterior chamber depth can be made with the help of pen light. The flashlight is shone from the temporal side onto the cornea, parallel but anterior to the iris. A shadow on the nasal limbus identifies the eye with a shallow anterior chamber, i.e., at the risk of closure. It is also important to remember that this is not the conclusive confirmation of angle closure, but should be referred for gonioscopy for further evaluation.

A gross examination of iris color can also be done with pen light. A difference in color between the two irises may be indicative

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of congenital abnormalities. Normal sclera is white and opaque and fibrous structure. Blue discoloration may be because of scleral thinning and underlying prominence of dark choroid.

Retinoscopy

Since the introduction of retinoscopy, it has been performed as one of the very first procedures during the eye examination. It is a great tool to establish a strong basis for the refractive status of the eye on which subjective refraction can be followed. In addition, retinoscopy helps to detect the aberrations of the cornea and the crystalline lens. It also provides some clues in respect of opacities of ocular media. Retinoscopy is particularly a very helpful tool with uncooperative or malingering patients, infants, deaf, and in all those cases where language or communication creates difficulties during the process of refraction.

Autorefractometry

Autorefractometer is an automated, fast, and very reliable method of objective refraction. The results obtained from the autorefractometer are highly repeatable. It not only provides several estimates of the refractive error but also suggests an average reading that can be used as a basis for subjective evaluation of the refractive error. The procedure takes hardly a few seconds. Several readings are taken which the machine averages to form a prescription. No feedback is required from the patient during this process. Within few seconds, an approximate measurement of a person's prescription can be made by the machine and printed out.

Keratometry

Keratometry is an instrument used to measure the front surface curvature of the cornea. The readings provide information as to the corneal astigmatism which may be used as baseline cylinder correction needed for the patient. However, the amount of astigmatism derived by a keratometer may differ from that of spectacle refraction. It may be more than the spectacle refraction or less than the spectacle refraction or may be same. Besides, it can also provide qualitative assessment of tear film and corneal integrity.

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Multiple Choice Questions-Answers

1. **When recording a patient's history who is complaining of symptoms of CVS, which of the following information is not relevant?**
   a. Details regarding difficulties in light/dark adaptation
   b. Any difficulties in bright light
   c. Details regarding office-lighting arrangement and workstation ergonomics
   d. Whether there is any history of ARMD

2. **Which of the following statements is true regarding keratometry?**
   a. It measures the curvature of the anterior surface of cornea
   b. It provides information as to the proportion of corneal astigmatism
   c. It provides the qualitative assessment of tear film and corneal integrity
   d. All of the above

3. **Which of the following statements is not true?**
   a. Pupil should constrict with light shone onto either eyes alone
   b. Lack of direct pupil response to light shone implies a problem with sensory inputs from the eye and lack of indirect pupil response to light implies problem with motor connection to fellow eye
   c. Normal Hirschberg reflex is seen at 5° toward the temporal side at the same position of both eyes
   d. A difference in color between the irises of the two eyes may indicate congenital abnormalities

4. **Which of the following is correct about retinoscopy?**
   a. It gives the initial view of the inside of the eye
   b. It helps to know the refractive status of the eye
   c. It is not dependent upon the subject's response
   d. All of the above

Answer Key

1.	**(d)**	**2.**	**(d)**	**3.**	**(c)**	**4.**	**(d)**

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Self-Practice Questions

1. **Why is it important to know the patient and patient's visual environment before deciding the treatment plan for cases of CVS?**
2. **How do visual demands for people working with visual display units use differ from those of sports athletes and players? Also, explain taking clues from common lifestyle of general population.**

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Build and develop your practice to manage patients successfully presenting symptoms of Computer Vision Syndrome (CVS).

If you want to build and develop your practice as a CVS specialist, read this book. This book is the most inclusive book to help you on your journey from being an outstanding practitioner to becoming a great inspirational and influential specialized practitioner.

This book will help you to:

- Know what causes computer vision syndromes
- Know how you can examine and diagnose
- Know how you can manage
- Know what treatment options are available.

This book will also help you understand the following:

- Usefulness of anti-reflection lenses
- Usefulness of blue-cut lenses.
- You get more than what you expect. MCQs and self-practice questions are also included.

The book has been translated into Arabic language.

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