

MAJOR REVIEW

Visual Complaints From Healthy Children

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Abstract. It is common for healthy children with specific visual complaints to be seen for eye examinations. After a complete eye examination has ruled out pathologic conditions as the cause of these complaints, it is appropriate for the clinician to explore the possibility that normal entoptic or physiologic visual phenomena might have provoked the child's report of vision problems. Some of these normal visual experiences are frequent causes of children's complaints of vision problems, such as physiologic diplopia, relaxation of the near synkinesis during reading, and vitreous body floaters. Some complaints are common, even though the underlying entoptic or physiologic phenomenon may be speculative or obscure, such as the report that objects look bigger or smaller than they actually are. When the clinician encounters such situations, the parents and the child will be much more satisfied by an explanation of the normal system anatomy and physiology than by the simple reassurance that everything is all right. (*Surv Ophthalmol* 44:113–121, 1999. © 1999 by Elsevier Science Inc. All rights reserved.)

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During the course of the day in a busy pediatric ophthalmologist's office, there is likely to be a child, perhaps even several children, whose normal eye findings fail to elucidate the cause of the chief complaint. It is always tempting on those busy days merely to reassure a parent that the child's eyes are normal, and, whatever the problem might have been, it is not now present. However, such a comment is usually not well received by the parent, as it seems to demean the child.

In our experience, most, if not all, of these situations derive from children's reports of visual symptoms related to normal entoptic or physiologic phenomena. As such, it is best to take an extra moment to obtain a more detailed history from the child, with the intent to ascertain which of the many entoptic phenomena or other physiologic visual experi-

ences the child might have noticed that led to the report of a vision problem. Children are curious and observant people, and they are seldom reluctant to voice their observations. For example, when a child reports diplopia to a parent, a flurry of activity often follows, because the child's symptom sounds portentous of a serious underlying health problem. If, in addition to documenting normal eye findings, the clinician also obtains the history that the diplopia is never present on the object of regard but rather on objects either closer to or further removed from the observer, the clinician can then not only reassure the family that the eyes are healthy, but also explain the phenomenon of physiologic diplopia. The latter explanation is of great additional reassurance to the parent(s), whose satisfaction with this encounter with the ophthalmologist goes up proportionately.

The entoptic phenomena mentioned in the following pages have been discussed to a greater or lesser extent by other authors, some of whose work dates back hundreds of years. To our knowledge, however, there has been no previous report of the variety of such phenomena appearing as children's chief complaints. The emphasis of this report is to demonstrate the usefulness of keeping such phenomena in mind in the pediatric ophthalmic office.

Although it is worthwhile to have an understanding of the prevalence of reasons for children's eye examinations,²⁶ it is not our purpose to answer questions of incidence or prevalence of children's visits prompted by these observations of normal visual phenomena. Suffice it to say that hardly a week passes without each of us enrolling one or more children in the class of astute observers with such complaints.

Chief Complaints and Their Prompting Causes

Table 1 lists the chief visual complaints of otherwise healthy children for whom we have cared, together with the underlying entoptic or physiologic phenomenon prompting them and, where applicable, pathologic conditions that can have similar chief

complaints. In the ensuing discussion, we comment in detail on some of the more common (and a few of the uncommon but interesting) chief complaints.

The following points should be kept in mind as one considers the entities included in the discussion.

1. The assignment of an entoptic or normal physiologic phenomenon as the basis for a child's chief complaint is predicated on two conditions having been met. First, the child's eye findings from a complete examination are normal; and, second, historical details have been recorded and are consistent with assigning the cause of the chief complaint to a known entoptic or physiologic phenomenon.
2. A detailed explanation to the family of the basis for the normal child's chief complaint, i.e., one of the entoptic or physiologic phenomena, is always greatly appreciated.
3. It is not usually a dull or uninterested child, but rather a bright and inquisitive individual who notices and reports the visual phenomenon.
4. Children who are examined because of these observations or chief complaints manifest no distress or concern over them (unlike their parents), and they greet the explanation for

TABLE 1

Children's Chief Complaints, Entoptic or Physiologic Phenomena That Can Account for the Chief Complaint, and Pathologic Conditions That Must Be Considered When Children Are Seen With These Complaints

Chief Complaint	Normal Basis	Abnormal Basis
1. Print blurs with reading	Changes in corneal curvature from prolonged reading	Accommodative insufficiency; severe hypermetropia
2. Print blurs with reading	Relaxed accommodation	Accommodative insufficiency; severe hypermetropia
3. With reading, words swim together	Relaxed convergence	Convergence insufficiency; learning disability
4. With reading, words swim together	Epiphora	Convergence insufficiency; learning disability
5. The chalkboard blurs	Relaxed accommodation	Intermittent heterotropia
6. I see double	Physiologic diplopia	Intermittent heterotropia
7. I see spots	Vitreous body floaters	Vitreous body blood or inflammation
8. There are colored lights in my vision	Afterimages	Migraine; retinal disease
9. What I look at during the night disappears	No foveal scotopic function	Retinitis pigmentosa; optic nerve disease
10. Things seem brighter with one eye	One eye dark adapted	Unilateral optic nerve disease
11. Things are different colors with each eye	One eye dark adapted	Unilateral optic nerve disease
12. When I look at the sky, I see things	Scheerer's phenomenon	Vitreitis; posterior vitreous detachment; vitreous body hemorrhage
13. When I push on my eye, I see a purple light	Mechanical retinal stimulation	—
14. When I look at something, everything else disappears	Troxler's phenomenon	—
15. Things look smaller (or bigger) than they should	Image size flux with accommodation	Retinal or central nervous system disease; psychological disturbance

the symptoms with interest, if not amusement (as opposed to their parent's obvious relief).

5. There are many more entoptic and physiologic visual phenomena than are included in Table 1 and the Discussion.^{1,28} We would be interested to learn of others, manifested among children, that might have come to the reader's attention.

Discussion

In the following paragraphs we will discuss in more detail the entoptic and physiologic visual phenomena listed in Table 1.

TABULATED CHIEF COMPLAINTS

1. Print Blurs With Reading (Scenario 1)

Complaints of blur with reading are common, but in our experience they usually derive from the two normal physiologic entities listed in the first two lines of Table 1, which we discuss in this section and section 2. Some children have true accommodative insufficiency or such severe hypermetropia as to have difficulty with reading, but these are rare conditions. In our experience, those who truly cannot accommodate easily and sufficiently for comfortable reading are almost always manifesting a side effect of a systemic medication, such as an antihistamine prescribed for the child's allergies.³⁰

The subject of blur with reading, frequently addressed under the headings *asthenopia* and *accommodative insufficiency*, has a long history, interest in the subject being generated by the very common experience of fatigability and blur with reading and other forms of near work. Early publications on asthenopia include those of Donders¹⁹ and von Graefe,⁶¹ whose understanding of this subject was based on clinical observations. Experiments with instruments, such as Howe's ergograph, Duane's accommodation rule, Blatt's accommodatometer, and Berens' several modifications of Howe's ergograph, were designed to demonstrate the fatigability of accommodation but yielded inconclusive data.^{7-10,20,21,36} In at least one discussion of this early work, it is suggested that the apparent fatigability of accommodation might actually be "mind fatigue,"⁵³ and in our experience visual performance with near work seems to be strongly correlated with the level of interest of the child.

There are, to be sure, a number of clinical entities characterized by absent or limited accommodation, including familial cases,³⁴ Wilson's disease,¹⁷ acute sinusitis,³¹ Adie's syndrome,⁵ chickenpox,^{23,48} and, among others, very probably idiopathic cases with no demonstrable underlying disease.¹⁵ Studies of the latter, though, rarely adequately control accommodation. As a result, there is very little convincing evi-

dence that accommodative insufficiency is as frequent as claimed, or that accommodation in young people is a fatigable function. In our own experience, children who report blurred near vision that cannot be explained by one of the physiologic mechanisms detailed below usually have normal accommodation. Their normalcy is demonstrated by testing stereoacuity. Children who on near vision testing report less than 20/40 near visual acuity, which should reduce stereoacuity to less than 100 seconds of arc, frequently easily identify the 40-seconds of arc target. Their increased interest in the stereopsis test elicits their full near visual effort and function. The belief that accommodation is probably only rarely a fatigable function is suggested by a study involving volunteers from the US Air Force, whose ocular motor functions were deliberately taxed incessantly over a period of days. In this study, no degradation of function could be demonstrated (personal communication with T.J. Tredici, MD, 1998).

We have listed several reasons for otherwise healthy children to experience blur at near, and they can be identified and discriminated from one another by obtaining additional historical details.

Children who do have true accommodative insufficiency always report that it is easier to read by pushing the book further from the face. To the contrary, those who develop blur from acquired changes in corneal curvature, a result of reading in prolonged downgaze and convergence for 15 minutes or more,^{11,27,38,40} find it easier to read through a compensatory shortening of the reading distance. These children also have noted by the time of their eye examination that their near blur is also accompanied by distance blur, both of which clear simultaneously by looking about the room for a few minutes. Furthermore, the blur is never so bad that they cannot continue with their work.

2. Print Blurs With Reading (Scenario 2)

The etiology of blur at near that results from corneal curvature changes from prolonged downgaze and convergence has completely different historical details from the blur that results from relaxation of the near synkinesis. Many children present with the observation that at any time after they start reading near vision becomes too blurry to continue reading. These children are observing relaxation of accommodation resulting from distraction. Anything that draws attention from the printed page results in suspension of the near synkinesis of accommodation and convergence, and near vision becomes blurred. The children (in most cases) note that blinking once or twice and redirecting attention to the book sharpens the image, at least for a time (until the next distraction).

3. With Reading, Words Swim Together (Scenario 1)

Many children with specific learning disabilities complain of words swimming or jumping about on the page. Recognizing this exception to our general rule that children with normal eye findings more often have no pathology, at least two "normal" phenomena are much more commonly the basis for this complaint than is primary convergence insufficiency. One is the relaxation of the near synkinesis, mentioned above in section 2.

The near synkinesis consists of accommodation, convergence, and pupillary constriction. When a distraction suspends the near synkinesis, both accommodation and convergence are relaxed, and the eyes diverge, contributing to an appreciation of blur, sometimes with an awareness of physiologic diplopia. As with the relief of symptoms described in section 2 of this discussion, voluntary redirection of attention to the printed page sharpens the image and relieves the diplopia that might have been noticed.

As with accommodative insufficiency, a number of pathologic conditions can result in convergence insufficiency, including systemic use of lithium,³⁷ sinusitis,⁷ and complications of previous bilateral medial rectus muscle recession for esotropia;⁷ however, a basic exophoria or an uncorrected refractive error probably accounts for the majority of patients who have remediable causes of convergence insufficiency. In evaluating these children, control of accommodation is critical. The outward drift with near fixation that is seen in many children disappears or is greatly reduced when an interesting, accommodative target is substituted for a nonaccommodative target. For some clinicians, bilateral medial rectus muscle resection has been useful for those with true convergence insufficiency not responding to orthoptic training,^{33,65} whereas surgery has not been as helpful in others' experience.⁶⁷

4. With Reading, Words Swim Together (Scenario 2)

The other common, physiologic source of a complaint that words swim together with reading is seen especially at the first- and second-grade level and is often accompanied by the additional complaint that the eyes water with reading. Very often, beginning readers blink infrequently while reading. The resultant corneal drying produces copious reflex epiphora. The large tear lake resting on the lower eyelid margin has irregular refraction properties. These children note that blinking clears their vision temporarily. They can be trained to blink more often while reading, but such training is unnecessary: more frequent blinks will accompany increased reading proficiency. Because corneal drying is a factor, this chief

complaint is more commonly heard during cold weather when room air is heated and dry.

In the older child, corneal drying from infrequent blinking may be a sign of symptomatic heterophoria or convergence insufficiency, because each blink allows the eyes to drift and necessitates a vergence recovery movement. It may well be in this context that these symptoms are included as a component of the convergence insufficiency syndrome, as described by Mazow.⁴¹

5. The Chalkboard Blurs

As in examples 2 and 3 above, inattention on the part of the child will allow any accommodative effort to be suspended. In the case of hypermetropic subjects (who vastly outnumber myopic and emmetropic children in the school-age population), the relaxation of accommodation results in blur until attention is redirected to the object of regard, even at distance fixation. There are also those children who have an underlying heterophoria, and who intermittently manifest it as a heterotropia, often with the appreciation of blur; but their heterophoria will usually be easily demonstrated by a complete eye examination.

6. I See Double

This chief complaint was mentioned as an illustration in our introductory remarks. To reiterate briefly, physiologic diplopia will be accompanied by the observation that the object viewed as doubled is at a different distance from the observer than the object of visual regard.⁶² It is sometimes helpful to show the child for his or her amusement the finger-sausage trick. While looking across the room the child places his or her two index fingers horizontally, fingertip-to-fingertip, in front of the eyes at a distance of about 14 inches. There will, to the child's delight, seem to be a finger sausage held between the two forefingers. By showing the child this trick, everyone in the family is given substantial reassurance that physiologic diplopia is not something about which to be concerned, and they all leave with the pleasure of having learned a new parlor trick.

Although it is one of the easiest of these phenomena to appreciate, physiologic diplopia, nonetheless, is not very frequently the basis for children's eye examinations. The reason for its being reported relatively infrequently is discussed by Duke-Elder and hinges on Panum's observation that two different contours cannot be perceived simultaneously in the same cortical locus.⁴⁹ According to Duke-Elder, "It is evident that the cortical rivalry of retinal images is a phenomenon that is as ubiquitous as fusion, and it is for this reason that the so-called *physiologic diplopia* is so seldom remarked in ordinary circumstances. It

is obvious that the rarity of physiologic diplopia is not simply a failure to 'appreciate' the phenomenon, as is commonly suggested; there is no need to invoke some psychologic explanation for the lack of awareness because the arrival of the 'second' image from one eye at a given cortical locus fails to excite recognition owing to the presence there of the 'first' image from the other eye. It is, therefore, unnecessary to avoid the awareness of physiologic diplopia by a process of suppression because double vision does not come into recognition but is kept in the background by the action of cortical rivalry."²⁵

It is appropriate here to reemphasize one of the key points of this discussion. One must always assign to the child's chief complaint one of the entoptic or physiologic phenomena peculiar to the visual system only after a thorough examination reveals normal eye findings. In the discussion of section 3 above, a variant of physiologic diplopia, that of diplopia with relaxation of convergence while reading, was stated to be a benign basis for the child's chief complaints. Similarly, physiologic diplopia occurring at times other than during reading is a benign phenomenon. However, diplopia from acquired extraocular muscle paresis is not benign, and the diagnosis of a paretic eye muscle is possible only with an accurate history and a thorough eye examination, including a complete muscle balance evaluation. True diplopia from an acquired extraocular muscle paresis is often the initial symptom and sign of mass lesions of the central nervous system, especially when more than one cranial nerve is involved and/or when accompanied by papilledema. The clinician is cautioned in this context and, indeed, in each of these discussions to remember the importance of a complete examination before making an assessment.

7. I See Spots

As mentioned in the introductory comments, most entoptic phenomena were studied and described more than a hundred years ago. In his treatise, von Helmholtz⁶³ included an extensive discussion of vitreous body floaters, citing in his discussion Dechales, who in the 17th century first suggested that this entoptic phenomenon was a result of opacities in the vitreous body.¹⁸ The worrisome causes of seeing dark spots or floaters, common in adults, are very rare in childhood. With the exception of vitreous body hemorrhage (sickle cell anemia, especially S-C disease, and diabetes mellitus) or inflammatory cell infiltration (uveitis), vitreous floaters are usually benign in children and are most often seen in myopia. An explanation of their basis and a prediction that they will evolve over time will allay many of the family's concerns. Light spots are most likely phosphenes, and as such they are usually in the periphery

of the visual field and are very evanescent. They are noticed commonly, especially while going to sleep. The observation that phosphenes are sometimes associated with accommodation is ascribed by von Helmholtz to Czermak.⁶⁴ Two other sources of phosphenes, Moore's lightning streaks^{6,44,45,60} and Nebel's phosphene of quick eye movement,⁴⁶ affect children only extremely rarely. Embolic disease is a rare cause of bright spots, and in children such disease would be most likely a result of heart valve vegetations or atrial myxomas.

8. There Are Colored Lights in My Vision

Although one must keep ophthalmic migraine and retinal disease in mind when a child presents with this complaint,⁶⁶ a common benign basis for colored lights in the vision is observance of afterimages.⁵² Staring in one direction for any length of time (25 to 30 seconds or more) results in retinal adaptation. Afterimages of the previous scene will occasionally be perceived upon redirecting the gaze, and these afterimages alternate between the color of the adapting stimulus and a more or less reciprocal color of the object that produced the retinal adaptation (yellow becomes blue, blue becomes red, etc.).³⁹

Afterimages are in some circumstances very easily appreciated, and they are certainly able to intrude into the consciousness. Duke-Elder lists some people who have found afterimages interesting enough to deserve investigation and comment: Aristotle, Aguilonius, Peirex, Descartes, Robert Boyle, Isaac Newton, Joseph Plateau, Robert Darwin, Goethe, Purkinje, Fechner, von Helmholtz, and Hering.²⁴ It is not surprising that children, on occasion, report visual phenomena that, on careful inquiry into the history, are typical of afterimages.

Occasionally, children have a complaint that does not fit the description of afterimages: they report seeing fixed, small colored lights throughout the visual field at all times. The duration of this problem can span years in some cases. Thus far in our experience, none of these children has developed local ocular or neurologic disease that might account for their symptoms. Spots of this kind have not significantly interfered with their daily activities. True hallucinations can produce a variety of visual symptoms, but they are rare in children who do not use hallucinogenic drugs, such as lysergic acid diethylamide (LSD).⁵⁸

9. What I Look at During the Night Disappears

One need only briefly explain foveal anatomy and physiology to relieve the concerns of the family whose child has this complaint. The need for photopic lighting conditions for cone functioning precludes utilization of the fovea under scotopic condi-

tions.⁴⁷ This anatomic limitation necessitates looking beside the dimmer stars to see them and is the basis for this (infrequent) chief complaint. Both optic nerve disease and retinitis pigmentosa can produce problems with night vision,⁶⁶ but usually central vision is relatively spared, compared to the peripheral field. Most childhood macular retinal and choroidal degenerations do not limit their symptoms of decreased visual acuity to scotopic lighting circumstances.^{4,12,51}

10. Things Seem Brighter With One Eye

Unilateral optic nerve disease would potentially result in this complaint,⁶⁶ but at least a few children have come into our offices with this presentation and a benign explanation. When a child rests his or her cheek on the palm of one hand with the elbow propped on the desk, the side of the face resting on the hand has the eye closed, and that eye is thus dark adapting. When the child next stirs and both eyes are open, there are a few moments when the world seems brighter to the dark-adapted eye than to the eye that had not been closed. This phenomenon does not last long, and the child readily notes that his or her observation of the difference in brightness between the two eyes is short-lived. (If the dark-adapted eye was closed for as long as half an hour, then the effect could last as long as an hour.³⁹) As with most of the chief complaints described in this writing, the child usually does not seem particularly upset by the visual phenomenon he or she describes, and it is usually the parent who leaves the office visibly relieved to have heard the explanation of the pertinent entoptic phenomenon.

11. Things Are Different Colors With Each Eye

A discussion for this chief complaint is similar to that in 10, above, but the entoptic phenomenon is a slightly different one. The sensitivity to shorter wavelengths of visible light differs depending on the state of light versus dark adaptation.³⁹ There is also a slight shift in color balance, as evaluated by the anomaloscope, depending on the state of light and color adaptation produced by the ambient light in the environment of the open eye.⁶⁸ Thus, our unilaterally dark-adapted student above will notice a slight difference in color between the two eyes, at least for a short time, when he or she opens both eyes. Sharing the distinction with the Troxler phenomenon, this is perhaps one of the least frequently reported entoptic phenomena among children.

12. When I Look at the Sky, I See Things

Scheerer's phenomenon reminds us that these normal visual experiences have long been known and discussed. Scheerer first explained the bright

spots, fixed in location but apparently moving along an unvarying track, that are seen when viewing a clear sky during the day, and his report is dated 1924.⁵⁴ Although similar subjective visual complaints might result from vitreitis or a vitreous hemorrhage, in the younger age group the far more frequent explanation would be Scheerer's phenomenon.

13. When I Push on My Eye, I See a Purple Light

Mechanical stimulation of the peripheral retina by digital pressure on the eyelid produces a sensation of light, usually of a purplish hue.⁶⁴ The reader may remark that this activity is hardly "normal" use of the eyes, and we would fully agree. Nonetheless, it is, on occasion, the presenting symptom in children. The mechanical equivalent of light stimulation of the retina is 0.00147 watt/lumen, which is a far lower energy level than that required by digital massage to produce a dull sensation of light. Some patients show an interest in this fact.

14. When I Look at Something, Everything Else Disappears

Peripheral retinal adaptation produces a gradual decrease in retinal sensitivity, when fixation is steadily maintained on one subject. In other words, when steady fixation on a static scene results in prolonged stimulation of the retina in an unvarying way, retinal adaptation causes loss of peripheral vision (Troxler phenomenon).⁵⁹ The instant refixation occurs or part of the scene shifts its position, full sensitivity is restored for any and all parts of the retinal image that change.

15. Things Look Smaller (or Bigger) Than They Should

The frequency with which we hear these complaints is surprisingly high. Micropsia and macropsia can indicate local retinal disease,^{3,29} central nervous system lesions,^{14,16} or psychological disturbance,⁵⁸ and it has been described after retinal detachment repair with reattachment of the macula,⁵⁶ and in association with multiple sclerosis¹³ and presumed ocular myasthenia.⁴³ We have found, however, no actual instances of disease-provoked micropsia or macropsia among the many children we have seen with a report of one or the other. The subject of the perception of micropsia unassociated with ocular or neurologic disease has been exhaustively studied, and the literature regarding micropsia is vast. The references cited here^{2,22,32,35,42,50,56} are included for the interested reader only as a representative sample of a much greater body of references, a very simplistic summary of which might be stated as follows: convergence seems to play a greater role in the subjective sensation of micropsia than does accommodation.

The usual explanation we give for micropsia in the typical situation in which the eye examination is normal is that described by Schlaegel⁵⁵: "The accommodative type of micropsia is seen mainly during the onset of paralysis of accommodation such as occurs soon after the instillation of cycloplegic drugs. At such time a near object is seen with great difficulty, so it is judged by the patient to be nearer than it actually is. Since the retinal image is small, micropsia results." Macropsia has a similar explanation, according to Schlaegel: "Macropsia may also develop suddenly in the presence of spasm of accommodation. In this case the patient finds that no additional accommodative effect is necessary to see an object close at hand; therefore, the object is judged to be at a distance. Because it is close and throws a larger than expected image on the retina, it is seen as being larger than it actually is." We believe that most children notice micropsia and macropsia from normal accommodative variability, not cycloplegics or accommodative spasm.

Taylor⁵⁷ stated that, in his experience, micropsia commonly occurs in children between 7 and 15 years of age, and it is especially associated with reading in bed. He finds no satisfactory explanation for the phenomenon, unless it is a "mismatch" between accommodation and convergence. As in our experience, Taylor finds micropsia to be a more common complaint than macropsia, and he discourages further investigation in children with an isolated complaint of micropsia and normal eye findings. To his suggestion that its treatment should be reassurance, we would add that a brief explanation of one underlying basis for these complaints (accommodative variability) is additionally reassuring.

OTHER ENTOPTIC AND PHYSIOLOGIC VISUAL PHENOMENA

We have encountered other entoptic and physiologic visual phenomena in our practice so rarely that they are not included in Table 1 or in the detailed discussion. For instance, children have observed and reported, albeit rarely, both dark adaptation (of both eyes, as opposed to unilateral dark adaptation) and lower visual acuity from using the peripheral part of the visual field, compared to the central (foveal) field, although identifying these normal physiologic phenomena as the source of the chief complaints required rather detailed histories. We would also mention a relatively common chief complaint from children, i.e., sheet music is difficult to see although no other near object of regard presents such difficulty, even fine print. We encounter this specific complaint from normal children frequently and are convinced that there must be some underlying physiologic basis for it, but we are not certain what the basis might be.

Conclusion

In closing, the typical child who presents with a visual chief complaint resulting from one of the entoptic or visual physiologic phenomena is not a mischievous child. Rather, in our experience, these are usually very bright children who are merely remarking on an observation. They tend to be interested in the explanation of their visual experience and receptive to reassurance. They are not dissemblers, and they openly manifest their appreciation for the time given them in the office. By taking the extra minute or two to flesh out their histories and recognize the basis for their visual observations, not only they but also we clinicians will find each of these encounters to be an educational and rewarding experience.

It should be obvious to the interested reader that there are many more entoptic phenomena and physiologic visual events as potential sources of visual complaints than are mentioned in this writing. If the reader has had a child report any of the other entoptic phenomena, we would be most interested to learn of each of them.

Method of Literature Research

The older literature was identified from the outlines of the history of these subjects in Duke-Elder's 1938 *Textbook of Ophthalmology*; Duke-Elder's *System of Ophthalmology*, especially the 1962 volume VII; and Albert and Edward's *The History of Ophthalmology* (Blackwell Science, Inc., 1996). More recent citations were identified in part by searching the key words *floater*, *micropsia*, *macropsia*, *retinal adaption*, *entoptic*, and *Scheerer's phenomenon* in the MEDLINE database, years 1966–1999. Most of the references cited in the review were identified from the bibliographies of the articles so identified. Eighteen references were not cited because of their lack of direct relevance to the subject. Articles in English and German were read from the original publications, and relevant articles from other languages were included when an abstract in English was available.

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