The determination of the necessity for wearing glasses / by D.B. St. John Roosa.

NECESSITY
FOR WEARING GLASSES.

D. B. ST. JOHN ROOSA

THE DETERMINATION

—OF THE—

NECESSITY FOR WEARING GLASSES.

—BY—

D. B. St. JOHN ROOSA, M. D., LL. D.,

Professor of Diseases of the Eye and Ear in the New York Post-Graduate Medical School and Hospital, Surgeon to the Manhattan Eye and Ear Hospital.

1887.
GEORGE S. DAVIS,
DETROIT, MICH.

PREFATORY NOTE.

The object of this little book, is to serve as a guide to the general practitioner in determining whether a given patient does or does not require glasses, either to aid the vision or to relieve a symptom that may not be directly referred to the eye.

It is by no means a complete manual of errors of refraction or failures in accommodation, but I believe that a careful study of these pages, will enable the practitioner to decide in a large proportion of cases, when the question comes up, whether or not glasses will probably be of service.

I also hope, that the very busy man who is not inclined to seriously study the subject treated of in this little volume may get from the short time that he devotes to it, an accurate idea of how much has been accomplished in the last quarter of a century in adjusting glasses for the improvement of sight, and the mitigation and cure of distressing symptoms.

New York, January, 1887.

CONTENTS.

CONTENTS—(CONTINUED).

CHAPTER V.

CHAPTER I.

History of the arrangement of test-types as scientific tests of visual power.— The invention of the ophthalmoscope made it possible to measure the refraction of the eye.—How glasses were formerly chosen. —Donders on Accommodation and Refraction. — Apparatus required for testing vision.— Classification of conditions requiring glasses.

It was not until the year 1854, that any systematic attempt was made by the medical profession to accurately estimate the visual power. During this year, Alfred Smee, in England, and Eduard Jæger, in Austria, published a set of test-letters, or test-types for this purpose. These tests were convenient, but insufficient. They consisted merely of a collection of paragraphs in type, ranging from the finest that is made, to very large letters, such as are used in handbills. They gave no idea as to how far each size should be seen by a normal eye, and beyond the statement of the ability of the patient to read fine or coarse type fluently or slowly, it was not possible with them—valuable as they were, and still are—to give an exact idea of the visual power of a given person. In 1868, Snellen, of Holland, published a set of test-types, which virtually showed the problem of registering vision. Snellen's types are founded upon the principle of *determining the smallest angle in which the*

*form of a given object may be accurately recognized.** Snellen's test types are large Latin letters, enclosed in a quadrangle. The height and breath of these letters are, as far as possible, five times that of each of the twenty-five small quadrangles, of which each letter is formed. The numbers above them CC, C, LXX, L, XXX, XX indicated the distance in Parisian feet at which these letters could be seen at an angle of 5′. The visual power is then expressed by a formula, as follows: The visual power V, equals the distance at which the letters should be seen, divided by the distance at which they are actually recognized by the patient. For example, if a patient sees letters that are normally distinguished at 20 feet, at only 10 feet, the formula would be $V = \frac{10}{20}$. In the latter part of this book are found a specimen of Jaeger's and Snellen's test-types, which, with these remarks, will make this part of my subject perfectly clear. Although Snellen's test-types, like Jaeger's, include also the finest type, the general practitioner, and, in many instances, the specialist, will be sufficiently accurate, if he limit his collection of test-letters to Jaeger's for near vision, and Snellen's for the distance of 20 feet. If convenient, matters should be so arranged that the visual power may be recorded as found with Snellen's letters at a distance of 20 feet. If the patient

* Functions prüfungen des Auges, by Snellen and Landoldt, Graefe and Saemish, Handbuch, Band III, Abtheilung I, p. 5.

cannot see No. XXX at 20 feet, he may see No. C or CC at that distance. Then his vision will be $\frac{20}{100}$ or $\frac{20}{200}$. In case he is not able to recognize even No. CC at 20 feet, he will, if he have any more than perception of light, see it at some lesser distance, for example at seven feet, when $V = \frac{1}{200}$. Of course the illumination of the room, which is often dependent upon the weather, and other conditions, influence the visual power to a considerable degree. These should be allowed for. But it is to be remembered, that absolute accuracy in measuring visual power is not attainable. even with the latest modifications and combinations of Snellen's system. Here, as in other matters, we must be content with an average statement. In general terms, we may say, that a person who reads No. I Jaeger fluently, from 4 to 8 inches from his eyes, and No. XX of Snellen's test types at 20 feet has normal vision. With a set of these letters, the practitioner may form sufficiently accurate ideas.

Intelligent school children readily learn series of letters, even in the few moments devoted to examining them in the consulting room. Unless two or three sets of letters are at hand, errors may arise from this source—not only with children and young persons, who will make an effort to learn the letters for the purpose of gratifying mischievous tastes—but also, in testing adults. Several series of test letters are now furnished by opticians. It is also to be remem-

bered that a certain facility in reading test letters is soon acquired. It is not proper to assume, that a person actually sees better at his second visit because he then reads $\frac{20}{30}$ when he before read only $\frac{20}{40}$— that is $\frac{20}{40}$ and one or two letters of $\frac{20}{30}$. He may read that much better by the little practice and experience acquired in the examination.

The signs + and — are appended to records of vision in this country to indicate as follows: If a patient's vision be $\frac{20}{40}$ + he can read all of No. XL and one or two of No. XXX. If it be $\frac{20}{40}$— he can read nearly all, but not quite all of No. XL, and so forth. Many persons, especially young persons, can read No. XX at a greater distance than 20 feet, but $\frac{20}{20}$ is an average representation of normal vision in average illumination.

If the practitioner be provided with a set of test types, and with a set of convex, and concave spherical and cylindric glasses, he may in a very little time, even if he has no knowledge of the use of the ophthalmoscope, determine whether a patient's real or apparent loss of vision depends upon an error of refraction, that is, upon an abnormality in the shape of the eye, or upon disease. Furthermore, a practitioner with a little leisure and a good ophthalmoscope, may learn to diagnosticate opacities of the lens and vitreous humor, and gross changes in the optic papilla and retina in a few weeks. This being done, he will make substantially accurate examina-

tions for determining visual power. Too much difficulty has been unconsciously ascribed to this whole subject. To learn the optical principles upon which depend the use of the ophthalmoscope, the formation of images, and the manufacture of lenses, is a matter requiring months and years of close study, but to know how to use the ophthalmoscope and to adjust correcting glasses, need not require very long.

It is only since the date mentioned at the opening of this chapter, that glasses or spectacles have been generally prescribed by a surgeon or oculist. Even the *oculists* of the days prior to this, did not attempt much more than to send their short-sighted and presbyopic patients, to an optician to determine if glasses would do any good.

The opticians to whom these people were sent were usually mechanics, with no knowledge of the structure or functions of the human eye, knowing at the most, how to grind convex and concave lenses. As a matter of fact, people who wore glasses selected them themselves,with a little crude help from the man who sold them.

As an illustration of what has just been said, the practitioner will be interested in a reference to a treatise on the eye, which was a standard work in Great Britain, France, Germany, and the United States in 1855–58.*

*A Practical Treatise on the Diseases of the Eye, by William Mackenzie, M. D.

In speaking of glasses for myopia, the author remarks: "When a near-sighted person wishes to be fitted with concave glasses, the simplest and surest plan is to try a series of them, at an optician's shop." Then some rules are given, but in the want of positive knowledge of what myopia really depended upon, these rules were not valuable, and probably were very little heeded by the optician.

The invention of the opthalmoscope by Heinrich Helmholtz, made it possible to change all this unscientific inexactness into scientific accuracy. As soon as the media of the eye could be examined, and the retina and entrance of the optic nerve studied, the proper classification of its refractive errors and accommodative failures were made. The types for testing vision followed. Then Donders presented the whole subject to the profession, very much amplified by his own discoveries, in his famous work upon the Accommodation and Refraction of the Eye.*

Not only were the indications for the use of spherical glasses very plainly set forth, but the great discovery of the value of cylindric glasses for astigmatism was also shown. A careful study of the work, with a little clinical experience, soon enabled the practitioner who knew the anatomy and physiology of the eye and the use of the ophthalmoscope, to properly adjust glasses for the patients who might be benefited by them. The haphazard and insufficient

* New Sydenham Society, 1864.

methods of the opticians, were replaced by exact and scientific measurement of the refraction and accommodation of the eye, by skilled men who could distinguish between incipient or advanced inflammatory or other morbid changes, and purely optical conditions, which may be changed by lenses.

The determination of the proper use of lenses for the improvement of sight, thus followed closely upon the invention of the ophthalmoscope. No exactness in the determination of the value of glasses was possible, until the lens, vitreous humor, choroid and retina could be in each case examined to determine if opacities or other morbid changes existed in them. The mirror which illuminates tissues which has heretofore been visible only after post-mortem changes had occurred, besides enabling us to study the diseases of the interior of the eye, made it possible to accurately measure its refraction. Ten years after the invention of the ophthalmoscope, surgeons in the large cities and towns of all civilized countries, were adjusting glasses for eyes whose prototypes had been considered as subjects of incurable diseases, or had been given over to the unscientific care of jewellers and opticians.

As I have said, it is not absolutely essential that the practitioner should know how to use the ophthalmoscope, in order to adjust glasses properly for quite a large number of cases requiring them. It is, however, of the highestimportance that every one who intends

to give any special and exact attention to conditions of the eye requiring glasses, should first be able to examine the eye by this means, else he may conclude that eyes that are diseased and need positive medical or surgical treatment, require only correcting lenses.

From what I have seen of the profession, I am of the opinion, that there is a large number of physicians who desire to be able to advise their patients as to when they need glasses. This can only be done when they understand how to accurately test the vision by the aid of convex and concave lenses. An armamentarium for this purpose ought to be in the office of every practitioner living where there are no oculists.

Apparatus required:

I. Three sets of test letters for examining the visual power at the distance of 20 feet.

II. A set of test letters for examining the visual power at a reading distance.

III. A double set of convex and concave spherical glasses running from glasses of 60 to those of 6 inches focal distance, or in diopters from 0.50 to 6.

IV. A prism of 6°.

V. Four single concave and convex cylindric glasses of 60, 48, 36, 24 inches focal distance, or 0.50, 0.75, 1., 1.25 D.

VI. A double grooved trial frame.

VII. One opaque disk.

VIII. One red disk.

These glasses and test-types may be procured at any optician's in the large cities. The whole apparatus will cost about twelve dollars and a half.*

It is by no means sufficient for the practitioner who desires to be able to accurately fit any given case. But it will be found sufficient for him who desires to determine whether or not the symptoms of the patient are probably due to the need of glasses.

Snellen's test-types for the distance, remain the standard, yet many new ones have been suggested, some of which have certain advantages when great stress is laid upon very fine tests. I am not, however, of the opinion that it is necessary, or at all important, to make a more exact test than may be furnished by Snellen's letters.

All the conditions of the eye requiring the use of glasses may be practically resolved into the following:

I. Presbyopia.
II. Hypermetropia.
III. Myopia.
IV. Asthenopia.

The reader may be at first surprised that astigmatism, the condition of unequal refraction in differet meridians of the same eye, does not appear in this classification. A little study will show, however, that every case of astigmatism may be resolved into one of the following conditions:

---

* Meyrowitz Brothers, of New York city, furnish such a case for this price.

1. *Hypermetropic astigmatism. Where the eye-ball is too short in one meridian only.*

2. *Compound hypermetropic astigmatism. Where the eye is too short in both meridians, and shorter in one than in the other.*

3. *Myopic astigmatism. Where the eye-ball is too long in one meridian and of the proper length in the other.*

4. *Compound myopic astigmatism. Where the eye is too long in both meridians, and longer in one than the other.*

5. *Mixed astigmatism. Where the eye-ball is too long in one, and too short in another meridian.*

6. *Irregular astigmatism. Where the same meridian is of different refractive power in different parts.*

It is thus seen that astigmatism is but a variety of either myopia or hypermetropia, or a mixture, if I may so speak, of myopia and hypermetropia in one and the same eye. It has nothing to do with a difference in refraction of the two eyes, as seems to be often supposed.

ASTHENOPIA.

Donders seemed almost inclined to believe that he had found the source of all asthenopia in errors of refraction. Certainly he placed a vast number in the correct category as depending upon hypermetropia and hypermetropic astigmatism, but there is still a

large contingent that is not relieved by glasses however skilfully chosen, or by drugs however aptly prescribed, but which remain as incurable as many other neuroses. Besides, a certain degree of hypermetropia and of hypermetropic astigmatism may exist with complete use of the eyes, without pain or other inconvenience. We cannot therefore conclude that we have found the source of asthenopia, or of headache because we detect an error of refraction of a low degree.

It may be doubted whether asthenopia has any claim to a separate place in classification, since it is almost always associated with an error of refraction, and because asthenopia, *weak sight*, is merely the expression of such symptoms as watering of the eyes, inability to continue to use the eyes on account of smarting, burning, or the like, headache, nausea, and so forth.

I am sure my readers will not for a moment confound a set of symptoms like these, which are comprehended under the term asthenopia, with refractive and accommodative errors. An asthenopic patient may be hypermetropic, or myopic, or astigmatic, or with no marked error of refraction, he may have weakness of the ocular muscles. Yet I think it better to classify asthenopia separately, for there is a uterine asthenopia from disease of the uterus or ovaries, as well as an asthenopia depending upon general causes, without an error or refraction, or at least without depending upon one.

For the better understanding of what is to follow I may add the definitions of all the conditions about to be discussed, although these definitions must be repeated in the subsequent pages.

1. *Presbyopia.*—A disease, or error, or failure in accommodation, or in the power of adjusting the eye to vision at different distances; a recession of the near point.

2. *Hypermetropia.*—Insufficient refractive power of the eye, usually dependent upon shortening of the antero-posterior diameter of the eye-ball.

3. *Myopia.*—Excessive refraction of the eye usually dependent upon elongation of the antero-posterior diameter of the eye-ball.

4. *Astigmatism.*—Unequal refraction of two meridians of the same eye, or of one and the same meridian.

5. *Asthenopia, or weak sight.*—Inability to continue to use the eyes. It may depend upon an error of refraction, weakness of the ocular muscles, disease of some organ of the body or other conditions.

CHAPTER II.

PRESBYOPIA.

Glasses have been used for its correction ever since they were invented to assist vision.—Accommodation; how it is accomplished.—Helmholtz's theory the accepted one.—Recession of the near point, the essential mark of presbyopia.—Method of adjusting glasses for presbyopia.—Astigmatism in conjunction with presbyopia to be corrected.—Second sight.—Illustrative examples of correction of presbyopia.

Ever since glasses were invented by Salvinus Amatus or Friar Bacon, in the thirteenth century, they have been used for presbyopia, or the sight of old age.

Convex glasses are used for the correction both of hypermetropia and presbyopia, but the two conditions should not be confounded. Presbyopia is a failure of the accommodative power of the eye, while hypermetropia depends upon an insufficient refractive power, usually due to a shortening of the antero-posterior diameter of the eye-ball, although in some instances it may depend upon insufficient refractive power of the lens alone.

The ciliary muscle acting upon the crystalline lens is the agent of accommodation. The accepted theory of accomodation, although it has some opponents, is, that in vision for near objects, the lens be-

comes thicker by the action of the muscle upon the suspensory ligament.

Helmholtz is the author of this theory. The fact that the lens becomes thicker on accommodation for near objects was, however, incontestably proven before Helmholtz showed how this was accomplished. His theory is that the contraction of the ciliary muscle causes the zone of Zinn to advance, and thus to diminish the traction exerted by it upon the crystalline lens. The lens then becomes more convex, especially on its anterior surface, by means of its own elasticity.

When the ciliary muscle becomes relaxed from a cessation of the innervation for accomodation for near objects,the ciliary process becomes tense,and stretches the zonula, which now flattens the lens by exerting traction upon it in the direction of the equator.

Presbyopia is a weakening of the power of accommodation for near objects. It is assumed that the ciliary muscle becomes weaker as time goes on, and the lens also becomes less elastic, and at 42 to 45 he who is not myopic, usually becomes unable to read fine type at eight inches from the eye. I say usually, because there are occasionally people over 50 years of age who are not myopic, and yet can read the finest type at 8 inches, with the naked eye. *The recession of the near point of vision is the distinguishing mark of presbyopia.*

This recession is caused by the two factors just

mentioned, weakness of the muscle and rigidity of the lens. It is not caused, as was formerely supposed, by flattening of the cornea.

Fine type, brilliant, is used to test the near point.

Widely as it is known among all people that sight for near or fine objects fails in old age, or even in middle life, presbyopia is very often a surprise even to educated and intelligent people, and they are shocked to find that they can no longer read fine print, or if women, see to thread a needle. Whenever clear vision at a proper distance becomes difficult, it is proper to seek the aid of glasses. They become to the overburdened muscle of the eye, as much of a necessity as food to the empty stomach, or a cane or crutch to him who has not the full power of his legs. There is no advantage in delaying their use. As has been said, it is at about the age of 42, that presbyopia makes itself markedly manifest, that is, it is at about this age, that the near point of distinct vision for fine print and the like, recedes to such an extent as to make it difficult to read or sew. To this, however, there are exceptions, the myope who begins life with an eyeball that is too long, does not require glasses to read with until very late in life, and sometimes, if the elongation of the eyeball be considerable, not at all. To this category belong many of the apparently marvellous cases of aged persons who read and write without glasses, but their power to do this is no evidence that they had particularly good eyes.

Again, people who are markedly hypermetropic in early life, in other words, those whose eyeballs are too short, are apt to require glasses for reading at an earlier age than 42, and they are obliged to wear stronger glasses than those who are simply presbyopic. Both the hypermetropia and the presbyopia must be neutralized: for example: a person who is hypermetropic to such a degree that a glass of 40-inch focus is required to neutralize it, will demand for reading the glass that is necessary for the correction of the hypermetropia together with that required for the presbyopia without hypermetropia.

Many persons do not learn that they are hypermetropic until they become presbyopic. They are able by extra or extreme use of the ciliary muscle, to overcome this congenital shortness of the eyeball, until the fatal boundry line of 42 to 44 years, is reached. Then they find their accomodative power so much weakened, or their lens so rigid, that they can no longer see perfectly at a distance, or at the best, they require a much stronger glass for reading or sewing than their fellow presbyopes who are not hyperopic.

Experience has pretty conclusively shown, that it is better to put on glasses when reading fine print becomes difficult without them, than to endeavor to postpone the day of putting them on. To delay the adjustment of glasses for presbyopia is simply to limit one's occupations and lessen one's comfort.

The procedure of adjusting glasses for uncom-

plicated presbyopia is exceedinly simple. Most of civilized mankind accomplish it for themselves, without the aid of opticians. There is, however, a small degree of risk in this, for glasses are sometimes changed for what is supposed to be only rapidly failing accommodation, when serious disease—*glaucoma* is impending.

The first rule in testing for presbyopia is the following:

The vision for the distance, say at 20 feet, is accurately estimated; each eye is tested separately. If it be $\frac{20}{50}$ or $\frac{20}{40}$ minus—no apprehension need be felt that any thing beyond presbyopia is to be encountered. If the vision for the distance be of this power, the patient should next be seated by a good light, and the convex glass sought with which he *is able* to read "No. I Jaeger," or the like, at eight inches from the eye, each eye being separately tested. It is not the glass with which he is able to read No. I Jaeger, *fluently and easily*, at that distance, for this is generally not an easy task for any but myopes and very young persons, but that glass with which, with some pains, he is able to make out all the words of a few sentences distinctly and with tolerable fluency. This glass will usually be found to be the proper one for work upon all near objects.

It is not always easy to find this glass, for some patients refuse for some minutes to believe that this distance of eight inches is merely, so to speak, a

testing distance, but they insist that they "never read at that distance," and decline to make the effort, but by making this distance the standard for the test, as has been said, the proper one is usually found. In addition to this test, it is well to cause the patient to read for a few moments with the glasses chosen, in an ordinarily printed book, held at the distance most agreeable to him.

If, however, the vision be not $\frac{20}{20}$, or nearly so, an attempt should be made to correct this before a glass is chosen for near work. If simple hypermetropia be the cause of the trouble, we shall have no difficulty, for at 42, the accommodative power is so weakened that spasm is not often to be feared. A weak convex glass is soon found with which vision becomes perfect, and this, as has been indicated, is added to the one usually required for beginning presbyopia. In general terms, it may be said that a person beginning to wear convex glasses on account of presbyopia requires one of 48 inches focal distance, or 0.75 diopters.

If the vision cannot be made $\frac{20}{20}$ by spherical glasses, those ground from a cylinder should be tried, and if astigmatism is found, the patient will find much comfort from the addition of the one needed to correct the astigmatism, to the spherical one required to correct the presbyopia. If the astigmatism be hypermertopic, the axis of correction will be the same for both far and near, but if the astigmatism be myopic, that is, if

the eye be too long in one meridian, the axis of the correcting cylinder should be at right angles to the one required for a distance. Thus, if a presbyopia have a myopic astigmatism of $\frac{1}{48}$ axis vertical, or 90°, for distant vision, in the glass for reading, it should be a convex cylinder with the axis 180°.

The convex cylindrical glass corrects the meridian that is not myopic. The myopic meridian either requires no glass at all, or one that is weaker, for that meridian being two long, has its near point, at a nearer distance than the emmetropic meridian. An example will be given at the end of this chapter which will illustrate and explain this.

Many presbyopes are never properly fitted with glasses because the astigmatism is overlooked. It is absolutely essential if comfort is to be had in wearing glasses for near work, that astigmatism, if present, whether it be hypermetropic or myopic, should be corrected. If the patient have hypermetropic astigmatism, a glass is virtually added to one meridian. If we have myopic astigmatism a glass is subtracted from this meridian.

If a presbyopic patient cannot be made to see $\frac{20}{20}$ or $\frac{20}{20}$—with any glass, we may be sure that there is some obscurity of the media, opacity of the cornea or cataract, or a disease of the preceptive apparatus. This of course can only be positively determined by examination of the cornea, by means of a lens and artificial light, and of the lens and vitreous humor, retina,

and so forth, by the ophthalmoscope. The general practitioner who has not learned to use this instrument will be obliged to stop at this point in these cases. But he can at least tell his patient, that he is not merely *presbyopic* but also *amblyopic*, and that no glasses will enable him to see clearly.

Paresis of the accommodation, as is well known, sometimes occurs as a result of diphtheria, acquired syphilis, injuries, and so forth. In this case convex glasses are often of service while recovery is taking place, or even if the paresis be permanent.

A presbyopic patient will require stronger glasses as time goes on. But no fear need be felt, if no organic disease exist in the eye, but that a glass may always be found to correct the error of accommodation.

The same rules apply for changing glasses as for first putting them on. At first, presbyopes will only require glasses in the evening and for small type, or for work upon fine objects, but soon they will be required by day. Then the glasses first chosen may be used by day, and a stronger pair at night.

The accommodative power is hardly established before it begins to decline in vigor. The near point of distinct vision for fine objects begins to recede in early youth, and when three score and ten are reached it becomes one with the far point, there is no accommodative power, no range of accommodation. This can not be entirely referred to want of contractile power of the ciliary muscle, unless the muscle is unlike

all the other muscles of the body. Their contractile power does not begin to diminish as soon as it is exerted. Hence many are inclined to think, that the failure in accommodative power is due almost, if not entirely, to loss in the elastic quality of the lens.

SECOND SIGHT.

In addition to what I have already said about those old people who read without glasses, I may remark that there is a kind of second sight that depends upon swelling of the crystalline lens. This of course makes the eye myopic. It is a condition of things that is very convenient so long as an opacity of the lens does not result. This artificial myopia may occur in one eye, and the other remain with insufficient refraction, so that a convex glass is needed in near work for one eyeand none at all for the other.

Second sight usually depends then upon myopia either congenital or acquired. Very many myopes think they have excellent vision for the distance, when they really see badly. It is no proof that a person has good visual power, because he thinks that he has. I make this remark because of the number of cases of second sight that are triumphantly adduced as occurring in persons who were never near-sighted. Only a test showing the contrary is proof that they are not.

EXAMPLES OF THE CORRECTION OF PRESBYOPIA.

CASE I.—*Hypermetropia with presbyopia. Lady*

of 40 requires a glass of 36 inches focal distance, to read fine type at eight inches.

Mrs. H. G., æt. 40. For the past year this patient has been troubled by pain in her eyes and head, and when she uses her eyes at night her sight blurs. The vision is $\frac{20}{20}$ in each eye. With a glass of 48 inches focal distance, it is the same. She can only read No. I Jaeger, at 8 inches with a $+\frac{1}{36}$. Her near point without glasses is about 12 inches.

This case illustrates what has been said in regard to the addition of a glass to correct the hypermetropia to the one required for the presbyopia. A person of 40, who is not hypermetropic, ought still to be able to read fine type at 8 inches without glasses, but in some a slight degree of hypermetropia renders this impossible.

Case II.—*Presbyopia complicated with myopic astigmatism in a man of 49.*

S. B., æt. 49. This patient requires a concave cylindric glass of 30 inches focal distance, the axis of the glass being at 100° for the right eye, and 75° for the other, to get his best vision for the distance $\frac{20}{40}$— on a dark day, which would be $\frac{20}{30}$ on a clear day.

For reading, we correct the emmetropic meridians as we would for an emmetropic presbyope, by putting a convex glass cylindric before them, while we leave the myopic meridian, when the near point is still at eight inches, or less, uncorrected. For the distance, the only meridians to be corrected are the myopic ones. Thus,

if the vertical meridian be myopic, it will require no correction, while the opposite one, which is emmetropic, or of the normal length, will. This shows why we put a convex cylindric glass with the axis at right angles to the one used at a distance over the eye for reading in cases of myopic astigmatism.

Case III.—*A hypermetropic of 48 years of age, requires a glass of 12 inches focal distance, to read No. I Jaeger.*

This patient only sees $\frac{20}{50}$ + from the right eye, and $\frac{20}{40}$ from the left, without glasses, witha convex, $\frac{1}{48}$, V= $\frac{20}{20}$. He requires a + $\frac{1}{20}$ to read No. I Jaeger; an emmetropic presbyope would only require a glass of + $\frac{1}{36}$. He must add the glass needed to correct the hypermetropia to the one for the presbyopia $\frac{4}{47}$. As his life goes on, the hypermetropia remains the same, but the presbyopia constantly changes until the period arises when no accommodative power remains.

Case IV.—*Presbyopia without manifest hyperopia.*

Mrs. T., æt. 55. Vision is $\frac{20}{20}$ with each eye without glasses. Her near point is fourteen inches; with a convex glass of two diopters. By the dioptric system this becomes much simpler. For example, the hypermetropia = 0,75 diopters, at 48 an emmetropia presbyopa requires usually a glass of 1 diopter, this added to the glass for the hypermettopia will give the reading glass 1,75 diopters (= $\frac{1}{18\frac{1}{2}}$), the near point is brought up to 8 inches, and this glass is prescribed.

Case V.—*Presbyopia just manifesting itself.*

H. W., æt. 47, merchant. This patient says that he suspects that he requires glasses because he cannot see fine type as well as he once could, especially in the evening. Vision in each eye is $\frac{20}{20}$ —. His near point lies at 10 inches in the left eye, and at 11 with the right. A glass of 1 diopter focal distance, brings the right up to 8 inches, while one of ¾ of a diopter, or 0.75, does the same for the left. There are ordered, and a month later the patient states that he has no difficulty in seeing.

Case VI.—*Simple presbyopia.*

Mrs. L., æt. 45. Has never worn glasses. Has observed that she holds her book far away to read, and her eyes burn while reading. Vision is $\frac{20}{20}$ with each eye. The near point in each eye is 13 inches; with glasses ¾ of a diopter, 0.75, it is brought to 8 inches, and these are ordered.

CHAPTER III.

MYOPIA—SHORT-SIGHTEDNESS.

An error of refraction.—Long recognized.—Prejudice against its correction.—Causes.—Simple test for its deteetion.—Accommodative myopia.—Prevention of myopia.—Examples.

We now leave the subject of failures of accommodative power, and turn to refractive conditions. These are, of course, independent of muscular contractility and of the elasticity of the lens, and depend upon organic changes or want of development in the eyeball itself. Myopia, like presbyopia, has been recognized, and to a certain extent scientifically managed for centuries. Glasses have been prescribed for its relief, and, on the other hand, charlatans have pronounced anathemas upon the use of glasses to relieve it, as they have against those for presbyopia. Hence to this day, there is to be found in many quarters, a prejudice against the use of correcting lenses, even when it is shown that vision without them is not nearly up to the normal standard.

Much of the nomenclature of medicine is unfortunate in the light of the knowledge of our time. Nowhere is this more marked than in the name myopia, from *muein*, to blink, from the habit of blinking which many myopes have. This they do to lessen the number of rays that enter the eye, by decreasing

the size of the pupil. Short-sightedness is a good English name which ought to be generally adopted.

Gustavus Adolphus was near-sighted, and it is said that he lost his life at the battle of Lutzen because he had no correcting lenses, and got among the soldiers of the enemy, thinking them to be his own. One of the most successful Union generals of our late war, more fortunate than the great Swedish commander, was wise enough to recognize the fact that he was astigmatic, and with the aid of an ingenious Connecticut mechanic caused a pair of cylindric glasses to be ground for himself, not knowing that they were generally to be procured, with which, he said to me, he was enabled to be a much better soldier than without them. Yet a great many people, and by no means are they always unintelligent or uneducated, prefer to see as they always have done, "in a beautiful haze," as one lady told me, than to be startled by seeing distant objects with distinctness. On the other hand, a New York patient once told me that after having been fitted with a pair of concave cylindrics for the first time, she turned around after walking down Broadway and walked up because she "had never seen it before in her life."

It is probably true that there have been myopic eyes ever since the world began, and yet carefully prepared statistics from many authors show that it is a disease increased by the occupations of civilized life. Catlin, the Indian traveler, thinks that Indians are not near-sighted.

Myopia is essentially a disease. It depends upon an elongation of the eyeball, from before backwards. It may be and often is a congenital condition, or it may be acquired. An eye of the normal length, an *emmetropic* eye, may elongate sufficiently to become myopic. A *hypermetropic* eye, one that is too short from before backwards may elongate, become emmetropic and pass through emmetropia to myopia. To fully discuss the causes of myopia does not fall within the province of this little book. It may be said in general terms that it probably depends upon venous congestion in the ciliary region of the eye, a congestion which finally leads to softening and elongation of the tissue. This congestion is favored by general mal-nutrition of the body with excessive use of the eyes upon fine objects, by insufficient light or in a stooping position. Heredity plays an important part in myopia. A vast proportion of those who consult physicians on account of myopia, have one or more myopic ancestors. The English are not so myopic a nation as the Germans. The reason for this is probably to be found in the habit of life in the open air among the former people, and the great national disposition of the latter to sedentary occupations, and in the employment by them of a peculiarly indistinct character in printing and writing.

Uncorrected myopia diminishes very much the capacity of the individual both for enjoyment and education in the large sense. To condemn a boy or girl

to see one-half that his fellows do, is to interfere seriously with his mental and even his bodily development.

The correction of myopia is not as simple a matter as the adjustment of glasses for presbyobia. Yet it is generally possible for a person even of limited experience to diagnosticate short-sightedness. *If a person cannot see large type say Snellen CC, or LXX, at 20 feet and can still See No. 1 Jaeger at 4 to 6 or 7 inches, he is almost without exception myopic.* This is, of course, a rude test, but one of value. It is one that may be made in a lonely cabin in the Alleghanies, if an ordinary newspaper can be found. The title of the journal will serve as No. xx or No. xxx Snellen, while the finest type may represent No. 1 Jaeger. If, however, a person cannot see large type at 20 feet, nor read fine type near the eye, there is something more than myopia. The eye is generally amblyopic from disease, but occasionally such a person is hypermetropic only. If he is hypermetropia the trial of convex glasses will settle it, is amblyopic it can only be determined by the ophthalmoscope, or in some cases by examining the eye by means of a 2½ inch convex lens and artificial light (oblique illumination).

The practitioner who is not able to examine the eye with the ophthalmoscope, can often make a diagnosis with the test-types and glasses, as follows:

The vision of each eye is separately examined with the test-types placeed at 20 feet distant. The

vision of myopes for the distance varies, of course, with the degree of myopia. A myope who requires a glass of 6 inches focal distance to cause parallel rays to focus upon his retina will rarely see more than $\frac{20}{100}$ without glasses, while he who requires one not stronger than 24 inches focal distance, will probably have a vision without glasses of $\frac{20}{40}$. Those unfortunates who have a myopia requiring a glass of 2 inches for its correction, will perhaps see only $\frac{6}{200}$ without glasses, and they may be well contented with $\frac{20}{100}$ with the myopia properly corrected. Myopia of the latter degree is indeed a misfortune. Such a person is shut off from all distant vision, and literally gropes his way through life.

Presbyopia as we have seen, is distinguished by the removal of the near point. In myopia the far point is brought near the eye. When the vision has been noted, and we suspect myopia, it is well to begin with *convex* glasses in endeavoring to improve the vision, for there are cases of hypermetropia that appear like myopia. If we find that convex glasses make the vision worse, we turn to the weak concave, and, testing each eye separately, we go on until we find the glass that produces the best result. Often patients are not able to say with which glass they have best vision, when the difference is not great. *In myopia the rule is to give the weakest glass that gives the best vision.* It is to be remembered, however, that many myopes can never get $\frac{20}{20}$ with any

glass. It is not to be expected in high degrees of myopia.

To over-correct myopia is to convert the myopic eye into one that is hypermetropic, and to add the troubles of asthenopia to those of indistinct vision. Myopes are not so apt to have "weak eyes" as hypermetropes. To correct simple myopia would always be an easy task, were it not that young myopes are very apt to add a certain degree of artificial myopia to that which is real, and which depends upon an elongation of the antero-posterior diameter of the eyeball. Besides this, some hypermetropes suffer from spasm of the ciliary muscles, and become *artificially myopic*. Young myopes will demand concave glasses that are too strong, unless their accommodation is paralyzed before the tests are made, while hypermetropes will reject convex glasses, which they really should have, and prefer concave, and see better with them; whereas, to give them, is to cause all their troubles to increase ten-fold. *It is, therefore, not safe to prescribe concave glasses to youug persons simply because they see better with them.* Before doing this, it is wise to instill a solution of the sulphate of atropia into each eye after each meal, for two or three days. Such a use of belladonna will put the accommodation at rest. If, after this, concave glasses of nearly the same strength as those which were required before the atropia was used, still improve the vision, the patient is undoubtedly myopic, and we need not hestitate to prescribe

the glasses that give the best vision. It is always a suspicious circumstance when a young person suddenly acquires poor vision which is markedly relieved by weak concave glasses. For example, if a young girl cannot read but $\frac{20}{100}$, and with a concave glass of 40 inches focal distance gets vision of $\frac{20}{20}$, we may be pretty sure that she is suffering from spasm of accommodation.

Provided glasses are properly chosen, it is well for myopes to wear them, and that pretty constantly. I have observed many intelligent and well educated short-sighted persons very carefully, and I believe the happiest myopes are those who make their glasses a part of themselves and wear them constantly in waking hours. There are of course exceptions to this rule, but they are not numerous. Here as in presbyopia as has been said, there is among some a prejudice against the use of glasses, but it is an unfounded one. Civilized beings should see as well as is possible. No harm and generally much good will result to anyone from a proper correction of an error of refraction or of failure of accommodation.

With all their disadvantages, myopes have still some advantages over hypermetropes and emmetropes. They can see very fine objects better than their neighbors, and in middle and advanced life they can often read without glasses, or with those with which they go about. Yet a myopic eye is subject to dangers that do not belong to others.

The authorities of the state, should take every care by building proper school-houses, with sufficient light and comfortably adapted desks, to prevent the advance of what may easily become in America, as it has already in some of the older countries, a great evil. Here, as in so many other conditions coming under the oculist's care, it is not only a matter of glasses, but also of the maintenance of the nutrition. All the wisdom of a most experienced practitioner will be required. Poorly lighted school-houses with poorly printed books, occupied and studied by poorly nourished children, will soon produce a race of myopes—while the opposite condition will do much to preserve humanity from the wide-spread increase of short-sightedness.

Myopic children should be examined at least once a year, to determine whether the myopia is increasing. It is perhaps not too much to ask that all young persons should be examined at least once in their lives as to the condition of their vision and refraction.

EXAMPLES OF THE CORRECTION OF MYOPIA AND OF SPASM OF ACCOMMODATION.

CASE I.—*Myopia in all meridians; more in one than the other* (*compound myopic astigmatism*).

Miss L., æt. 18. Thinks she has been near sighted for eight years. Has used glasses for five years. Is now using minus $\frac{1}{8}$ on the right side, and minus $\frac{1}{13}$ on the left, with which V = $\frac{20}{50}$ +.

She reads No. 1 Jaeger at 3 inches without glasses on the right side; at $3\frac{1}{2}$ on the left. The ophthalmoscope shows opacities on the posterior capsule of the right lens.

A four-grain solution of sulphate of atropia was dropped into both eyes, three times a day for four days. Vision was $\frac{10}{200}$ on the right side, and $\frac{15}{200}$ on the left, without glasses. After repeated trials, the following glasses were ordered:

R. E. $-\frac{1}{11}\bigcirc-\frac{1}{36}{}^{c}$ 170°.

L. E. $-\frac{1}{20}\bigcirc-\frac{1}{36}{}^{c}$ 180°.

With these V $=\frac{20}{20}$.

CASE II.—*Myopia accompanied by watering of the eyes, in a young girl.*

Winnie X., æt. 8. The little patient's mother states that two weeks ago the child began to complain of watering of the eyes while using them. The general health is good. R. V. $=\frac{20}{30}$. L. V. $=\frac{20}{70}$. Reads No. 1 Jaeger at 4 inches. After three days' use of the sulphate of atropia, with a concave glass of 72 inches, the vision of the right eye became $\frac{20}{15}$; with one of 36 inches that of the left became also $\frac{20}{15}$, and these were ordered.

This child is evidently just becoming myopic. Active hygienic measures will be necessary to prevent, if possible, an increase of the myopia.

CASE III.—*Myopia in one meridian; emmetropia in the other (simple myopic astigmatism), in a physician of 40.*

Dr. C., æt. 40. Has suffered from asthenopia

for some years. R. V. = $\frac{20}{50}$, L. V. = $\frac{20}{30}$ — with a cylindric glass of 48 inches focal distance on the right side, axis 90°, vision becomes $\frac{20}{20}$, and on the left $\frac{20}{20}$, with a concave glass of 72 inches focal distance. These were chosen while his eyes were under the influence of atropia; before this, he required a much stronger glass.

CASE IV.—*Simple myopia; vision greatly improved.*

Miss C. A., æt. 35. Patient states that she has worn glasses 22 years, and has been near-sighted all her life. Her vision without glasses is $\frac{20}{200}$; with a concave glass of 10 inches focal distance it is $\frac{20}{40}$. This is sometimes $\frac{20}{30}$, and these glasses were continued.

CASE V.—*Simple myopia; vision greatly improved by glasses.*

J. J., æt. 21. Has never been able to see well at a distance, but worse for the past two years.

His vision is $\frac{20}{200}$ on the right side, and $\frac{20}{100}$ on the left, without glasses. With a concave, 14 and 16 respectively, the vision becomes $\frac{20}{20}$. Concave — 2.50 diopters ordered for the right eye, and — 2 diopters for the left.

CASE VI.—*Myopia in one eye becomes hypermetropia in one eye, while a low degree of manifest hypermetropic astigmatism in the other eye, becomes simple hypermetropia after the use of sulphate of atropia. Heredity.*

Louisa C., æt. 12, complains that black spots

appear before the right eye. She suffers from asthenopia, and rest does not relieve the symptoms. Grandfather, father, and sisters are troubled with difference in the focus of the two eyes, R. N. = $\frac{20}{30}$ ×. It becomes $\frac{20}{20}$, *with a concave* 60°, axis 120°. L. V. $\frac{20}{30}$, becomes $\frac{20}{20}$ to *convex* $\frac{1}{60}$, axis 90°. After the use of atropia three times a day for 24 hours. R. N. becomes $\frac{20}{50}$, with + $\frac{1}{30}$ $\frac{20}{20}$. L. V. becomes $\frac{20}{70}$, and with a + $\frac{1}{30}$ $\frac{20}{20}$ −. She was advised to use atropia for a week. Her eyes finally settled down into simple hypermetropia and could be used with comfort with glasses. A patient of this age may hope to grow out of a part of the hypermetropia. The eyeball may develop and glasses be dispensed with.

CHAPTER IV.

HYPERMETROPIA.

Description of hypermetropia. Discovery of its existence made by the ophthalmoscope. Varieties of hypermetropic astigmatism. Examples of correction of hypermetropia and hypermetropic astigmatism.

It was the discovery of the widely-spread existence of hypermetropia, and of hyperopic and myopic astigmatism that led to the change in ophthalmic practice that has been for some years very marked, and which has been fully discussed in our first chapter. The number of people who were suddenly but properly found to require glasses was very large.

A hyperopic eye is one that is too short from before backwards. This abnormity usually depends upon shortness of the whole globe, but in exceptional cases it may depend upon changes in the lens or vitreous humor which have no effect upon the length of the eye-ball itself. Excluding the myopic, most of mankind are born hypermetropic, but the hypermetropia is either grown out of, or it is not of a degree requiring correction. The fact that many children require convex glasses as urgently as their presbyopic parents or grandparents, has led to the prescription of glasses by the physician instead of the optician. When by means of the ophthalmoscope, the eye could

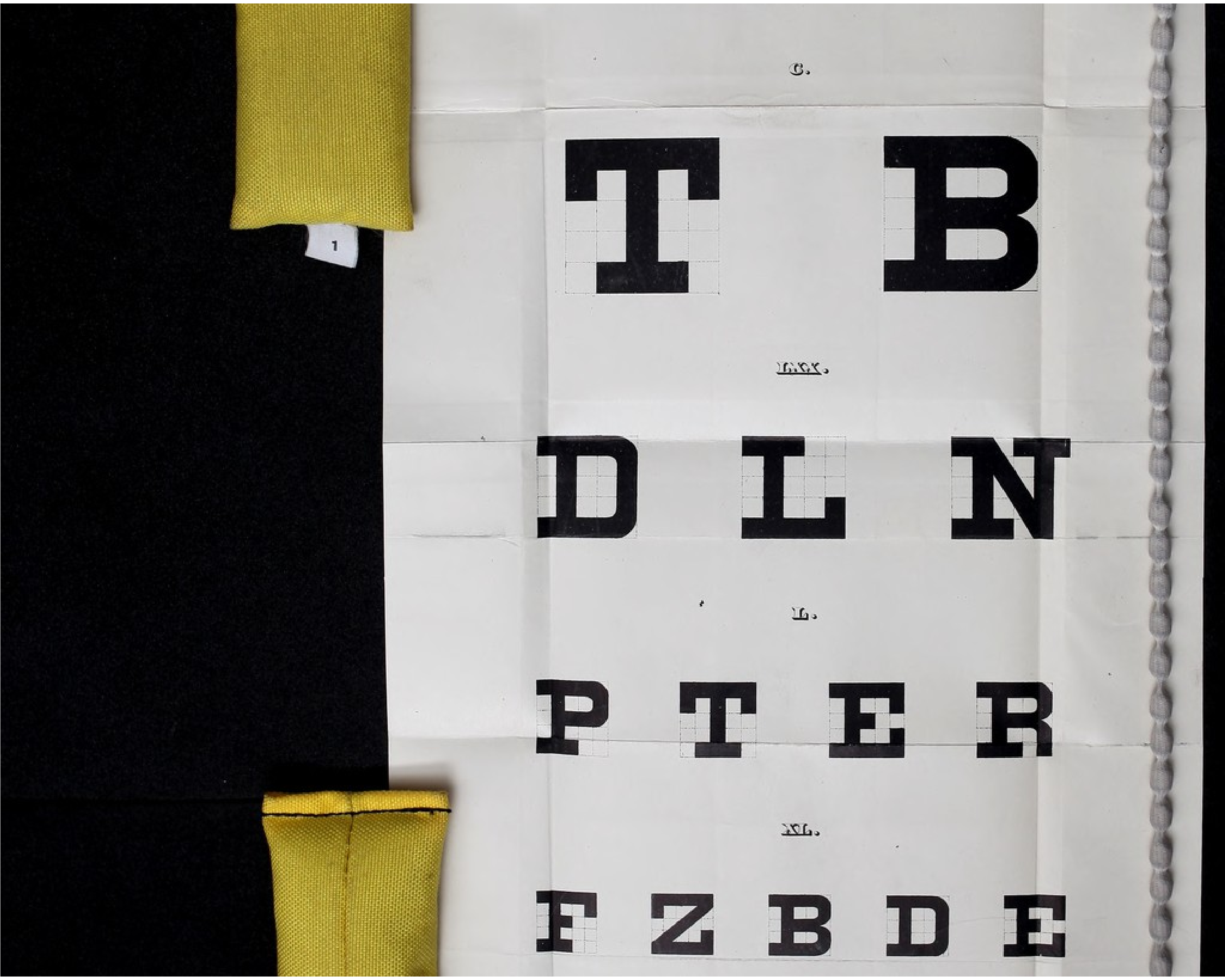
be accurately examined in its interior and its refractive power measured, the fact that there were thousands of young persons in the world whose sight could be made good with glasses soon became manifest. Before this, all young persons who were unable to use their eyes for any length of time without pain or fatigue, were supposed to have serious disease of the optic nerve or retina, and were rigorously excluded from all reading or the like. If, as some of them did, they found relief from convex glasses, they did it without medical advice, and wore them at their peril. Here and there it was known among scientific men, that there were "flat eyes" among young people, and that they could be benefited by correcting the insufficient refraction, but this knowledge was in the highest degree exceptional, and gained no circulation. Professor Dewey, of Union College, in New York, even wrote a paper upon the subject, but it attracted very little attention. This was, perhaps, due to the fact that it was published in Silliman's Journal, which was not extensively read by physicians. Yet, as I have intimated, it was not until the opthalmoscope was invented that these cases could be accurately and positively diagnosticated. To the invention of Helmholtz, we are indebted for the practical benfit that ten thousands of people, that formerly had no relief for their imperfect or weak sight, receive from the use of convex glasses.

Hypermetropia or hyperopia is divided into several varieties.

1. *Manifest hypermetropia.* In this form the vision is at once improved by convex glasses. If the patient be placed 20 feet away from the test letters, it will be found that his vision is defective. Let us say, for example, that he is only able to see letters that should be see at 70 feet, 20 feet away V= $\frac{20}{70}$, a convex glass of weak focal power, say 48 inches, is applied and the vision is raised to $\frac{20}{30}$, and finally one of 24 inches focal distance brings it up to $\frac{20}{20}$. If no stronger glass will give the same vision, the degree of hypermetropia is measured by the strongest glass that gives the patient $\frac{20}{20}$.

If no convex glass will bring the vision up to $\frac{20}{20}$, and especially if the patient miscall certain letters while he insists that he sees them correctly, we may suspect that not only is the eyeball too short. but that it is shorter in one meridian than the other, *hypermetropic astigmatism*, or that one meridian is too long, *myopic astigmatism.* To correct such a defect as this we require a glass that does not refract light in all of its meridians. This is to be found in a glass ground not from a sphere, but from a cylinder. As is well known, ordinary concave and convex glasses are ground from a sphere, and are called spherical glasses.

When an examination leads us to suspect the presence of astigmatism, spherico-cylindric glasses are taken, beginning with the weak numbers, and while


1
C.
T B
LXX.
D L N
L.
P T E R
XL.
F Z B D E

the patient has before his eye in an appropriate frame the convex glass with which he sees best, the cylindric is added and its axis rotated until we hit upon that one which brings the vision up to $\frac{20}{20}$ with no miscalling of the various letters. Many distinguished oculists make use of tests containing radiate lines, like the dial of a clock, but I regard them as unnecessary if the method of testing be carried out as has just been indicated, and I have long since discarded all tests but letters.

Latent Hypermetropia.—Manifest hypermetropia and manifest hypermetropic astigmatism are not always found, however, in those who really are hyperopic and astigmatic. In many persons the defect is concealed by spasm of the ciliary muscle, and vision may be $\frac{20}{20}$ without glasses, or it may be $\frac{20}{40}$ and no improvement be effected by the use of any glasses, and yet an error of refraction causing much distress in using the eyes, may exist. This is *latent or concealed hypermetropia.*

As has been already observed, this real condition of things may simulate myopia. The use of the sulphate of atropia in a four-grain solution in each eye for three days will usually reveal latent hypermetropia if it exist. The effect of atropine and other agents which act upon the accommodotion in an *ideal and emmetropic eye* is simply to prevent the subject from accommodating for near objects. In such an eye, vision at a distance remains unchanged. If it was $\frac{20}{20}$ before it will remain so after the ciliary muscle has ceased to act.

An emmetropic eye does exist, although, as I showed in 1878,* it is exceedingly rare. Most eyes that are not myopic, when under the full influence of atropia, are improved in distant vision by a weak convex glass, say one from $\frac{1}{60}$ to $\frac{1}{42}$, D 0.50° to D 0.75°. As I have most of mankind are hypermetropic. These slight degrees are not necessarily any cause for weakness or impairment of vision It has sometimes been hastily concluded that a cause is found for asthenopia, headaches, nervous diseases, and so forth, because a low degree of hypermetropia or hypermetropic astigmatism is discovered. Now it is true, that the correction of a low degree of latent hypermetropia, and more especially of hypermetropic astigmatism, may sometimes relieve asthenopia and headaches, yet as a rule, it is only when the hypermetropia is of a degree requiring a glass of 36 inches to 24 inches for its full correction that any great benefit is realized from the use of convex glasses. There are, however, in every oculist's notebook, as there were in the published cases of Donders, who first fully utilized spherical and cylindric glasses—convex and concave—many wonderful cases of great relief from serious nervous symptoms simply by the use of or a change in glasses. There may be spasmodic action of the ciliary muscle which sometimes produces a train of symptoms that no drug will reach, but which are relieved by the proper adjustment of spectacles.

---

* Transactions of the American Ophthalmological Society.

It is not proper to fully correct the degree of hypermetropia that may be found when the accommodation is paralyzed, especially in very young people. A certain degree should be left uncorrected. For example, if a total hypermetropia of $\frac{1}{20}$ be found a correction of $\frac{1}{30}$ will usually be sufficient for a person under 40. *The full degree of of astigmation may generally be corrected, however, with benefit.*

Patients having latent hypermetropia, who have very good vision for the distance when not under the influence of atropia—vision say of $\frac{20}{30}$ or $\frac{20}{20}$—should only wear glasses for close work—reading, sewing, and the like. They will not appreciate the difference between $\frac{20}{30}$ and $\frac{20}{20}$ or even between $\frac{20}{40}$ and $\frac{20}{20}$, as any emmetropic person may convince himself by adjusting concave glasses upon his own eyes, making himself hypermetropic say a $\frac{1}{48}$th. If he will then note the difference in his visual power with or without the artificial hypermetropia, he will find for ordinary vision that it is not great.

3. Facultative or voluntary hypermetropia.—There is a class of patients who see at a distance equally well with or without convex glasses. They will see $\frac{20}{20}$ with no glass or with a convex one. Such persons are hypermetropic, for no emmetrope can wear even very weak ($\frac{1}{120}$, 0.25 D.) convex glasses without being conscious of some blurring of the vision when he looks at the test types placed 20 feet away. This variety of hypermetropia may, like the latent and manifest,

cause asthenopia. It is not, however, usually necessary to place the eyes under the influence of atropia to correct it, but the highest glass with which the best vision is obtained will be the proper glass for close work.

ASTIGMATISM.

There is perhaps no better place than this to speak of the diagnosis of hyperopic astigmatism, and of astigmatism in general. It is a subject upon which some confusion of ideas seem to restin the mind of the profession at large. I have heard some practitioners describe astigmatism as the condition in which the refraction of one eye, is different from that of the other. Astigmatism, however, is that condition in which the refraction of one meridian of the eye differs from the other. This difference of refraction in the meridian confuses or takes away from the sharpness of the retinal image. This defect exists in all eyes, but not to such a degree as to render a correction of it necessary. Astigmatism is only likely to produce any disagreeable influence upon the vision when a glass of 60 inches focal distance is required for its correction, and not always even then.

THE USE OF ATROPIA.

A word or two should be said for the benefit of those who do not often use sulphate of atropia for the purpose of paralyzing the accommodation. Atropia very rarely produces constitutional symptoms when dropped into the conjunctival sac, but it sometimes

does. The following precautions should therefore be taken in using it:

1. The solution should be dropped in the outer part of the conjunctival sac, and not in the inner, lest it get into the mouth through the canaliculi and the nasal duct.

2. The solution should only be used soon after eating, not after a long abstinence from food.

3. Only one or two drops should be used—for each application.

Unless the physician is very precise in his instructions to his patients in regard to the use of a solution of atropia in the eye, they will not use it with sufficient thoroughness, or as directed. For example, they often become alarmed in regard to the loss of sight which its use causes, and they decline to continue it after the first instillation; and they often, also, omit to put it in the eye on the day of their return to have the glasses fitted. To put ordinary eyes at rest, a four-grain solution should be used once after seven meals, that is to say, for two days and a half, and very often for even a longer period. It is a troublesome and trying means of getting proper glasses, but in many young people, or persons under 40 years of age, its use cannot be dispensed with, while the results in such cases are worth all it costs to use it.

Examples of the Correction of Hypermetropia and of Hypermetropic Astigmatism. Latent Hyperopia with Blepharitis Ciliaris.—Miss L., æt. 35. This patient

complains of a dimness of vision in reading, and of a strained feeling. She also has *blepharitis ciliaris.* In the right eye the vision is $\frac{20}{50}$ minus, left $\frac{20}{30}+$. No glass improves the vision of either eye, but a convex cylindric glass on the left eye does not make the vision any worse (facultative or voluntary hyperopic astigmatism). After the use of atropia for four days, she was found to have a hypermetropia of $\frac{1}{18}$ on the right side and $\frac{1}{20}$ on the left. She was advised to wear a glass for readieg of $\frac{1}{30}$ over each eye.

Blepharitis ciliaris is a disease very often caused by strain of the accommodation, and is often relieved or cured by the adjustment of glasses.

CASE II.—*Hyperopic Astigmatism and Blepharitis.* —Mr. R., æt. 33, clerk. This patient is obliged to use his eyes in writing many hours in the day and evening. Suffers from asthenopia. There are crusts about the roots of the hair follicles, and the ocular conjunctiva is congested.

R. V. = $\frac{20}{50}$ +; accepts no glasses.

L. V. = $\frac{20}{70}$ with + $\frac{1}{11}$ c axis 75° $\frac{20}{40}$.

After the use of atropia for three days, the vision of this patient was increased to $\frac{20}{30}$ on each side by a cylindric glass (+1, 50-90° Diopters) on one side and a spherical combined with a cylinder on the other.

CASE III.—*Latent Hypermetropia, with Asthenopia.* —Minna E., æt. 26. For $2\frac{1}{2}$ years this patient, who is a seamstress, says that she has suffered from asthenopia. Her vision is about normal, $\frac{20}{20}$—each eye. After

three days' use of atropia, her vision for the distance was reduced to $\frac{20}{100}$, but with a 30 inch convex glass on one side and a 24 on the other it became normal. She rejected glasses before the atropia was used.

CASE IV.—*A physician of 38 with facultative hypermetropia and weakness of the internal recti, finds great relief from putting on glasses.*—Dr. B., æt. 38. This gentleman states that he has had headaches for 15 years, and pain in his eyes when and after using them for a few months. His vision is normal. It is the same with a glass of 60 inches focal distance, and, in a few days, with one of 40 inches focal distance. Glasses were ordered for reading, and so forth. The patient was under observation for some weeks. His eyes and head were much relieved.

CASE V.—*High degree of latent hypermetropia.*—Mary L., æt. 12. Complains that there is a blur over her eyes when reading. Her vision without glasses is nearly normal, $\frac{20}{20}$. Under the thorough use of atropia for five days, her vision without glasses was reduced to $\frac{10}{200}$ in each eye, and brought to $\frac{20}{20}$ with a spherical glass of 8 inches focal distance, combined with a cylindric glass of 36 inches focal distance for each eye.

In giving this patient glasses for reading, the rule was followed of correcting all the astigmatism, but only a part of the general hypermetropia. The following formula was advised:

R. & L. $+\frac{1}{18} \supset + \frac{1}{36}{}^{c}\ 90°$.

CASE VI.—*Latent hypermetropia with amblyopia, the latter relieved by glasses after the use of atropia.*—Josephine M., æt. 17. Patient says she can read for about five minutes, and that after this she can't see. The patient is in good health. Her vision is $\frac{20}{50}$ in each eye and is not improved by glasses. Under the use of atropia her vision is reduced to $\frac{8}{200}$ in each eye, but brought up to $\frac{20}{30}+$ with convex glasses of 6 inches focal distance. Since her vision was considerably below the normal without glasses, she was advised to wear glasses constantly, and a convex $\frac{1}{18}$ was ordered.

By the ophthalmoscope, before atropia was used her refraction was found to be hypermetropic as much as 6 diopters.

CHAPTER V.

THE VALUE OF PRISMATIC GLASSES.—THE CURE OF CONSTITUTIONAL DISEASES AND THE ALLEVIATION OF THE SYMPTOMS OF NERVOUS DISEASES BY THE USE OF CORRECTING GLASSES.

Prisms used in connection with convex and concave lenses. Methods of testing weakness of the ocular muscles. Limitations in the curative power of glasses.

THE VALUE OF PRISMATIC GLASSES.

In certain cases of weakness of the internal recti muscles, prismatic glasses are of value but generally for temporary use. They are combined with convex or concave glasses. When there is, as is usually the case, an error of refraction as well as the weakness of the internal recti. The prismatic glass, as every student of optics knows, apparently displaces objects by refracting light towards its base. One of the best tests of insufficiency of the internal recti is to place a prism with the base upwards or downwards in front of one eye, and then to cause the patient to look at a cross (†) held at about the ordinary reading distance in front of the eye, when he will observe two dots or cross-lines, one directly above the other, if the recti be of proper

strength, but if insufficiency exists, these dots will be separated laterally. If the insufficiency be of the interior, the image from the right eye will be on the left side, and *vice versa*. By placing other prisms base inward before the eye, the dots may be brought into the same vertical line. The strength of the prism required will be the measure of the deviation. A candle may be used instead of a dot when the test is used for a distance beyond the one employed in reading. Prismatic glasses, unlike convex or concave glasses, are seldom used for a long period of time, but usually only for a few months or a year or so at the most, as a means of toning up weak muscles. They have no such extended application as glasses for the correction of errors of refraction and accommodation. Prisms are sometimes used to give the eyes strength by gymnastic exercises. If the desire be to examine the internal rectus, the base is placed outwards. This displacing the rays towards its base and those from the object will be deviated outward, and the image will be formed upon the retina outside of the macula. The eye will endeavor to overcome this by rolling inward, which motion, of course, pulls the macula outward. It is very doubtful if this kind of exercise of the ocular muscles has a very curative value, although much was expected of it at one time.

The dot test for insufficiency sometimes fails to reveal a considerable weakness of the interni, and the following one should always be

resorted to when the test known as Graefe's test, fails to detect a weakness of the muscles:

A prism, base outwards, is placed before one eye, while the other is covered with a transparent red glass, and the patient is told to look at a candle placed some twenty feet away. If the prism be one of low degree, unless the muscles are very weak, double vision will be produced for an instant only, when the images will blend. The rays entering the eye through the prism are bent towards the base of the prism, that is, outwards, and the image will fall outside of the *macula lutea*. This of course produces double images, which are blended by the action of the internal rectus which rolls the eye inward and displaces the macula outward, to accommodate it to the displaced ray.

Now if we reverse this procedure, and place a prism before the eye with its base inward, the light is bent to the inner side of the macula, and if the muscle has sufficient power the external rectus pulls the eyeball outward and displaces the macula inward, when the image can be formed upon it. The *adducting* and *abducting* power of the muscles, that is to say, the power of the external and internal recti, are thus tested. The average power of the external rectus enables it to overcome a prism of 8°–10° of the internus of 19°–20° when regarding an object 18 feet distant. If by neither the dot test or the one just described

weakness of the muscles be detected, we may believe that they have normal power.

THE CURE OF HEADACHE, VERTIGO, AND OTHER SYMPTOMS BY THE USE OF CORRECTIVE GLASSES.

While there has been much of exaggeration in some of the claims that have been made for the cure of headaches, vertigo and more serious affections by the use of glasses, it still remains true that many symptoms that do not appear to be related to the eye are often removed by the use of correcting glasses. The claims put forth some years since, that chorea depended upon an error of refraction, was necessarily abandoned when it was shown that chorea was cured without glasses, indeed that it had been recovered from when the use of glasses for hypermetropia and astigmatism was practically unknown.

In the same way, the extravagant hopes raised by the cure of headaches, and so forth, by the use of glasses, which have led to the universal reference of grave constitutional disorders, such as epilepsy, to the accommodation and action of the ocular muscles, must finally be given up. Yet headache is often relieved more or less completely by the use of cylindric glasses for the correction of astigmatism, and serious nervous symptoms and even epilepsy have often been benefited in the same way after general treatment has been of no avail.

Did the scope of these pages allow, I could fill

much space by the recital of many cases of this kind. A few only will be given. It therefore behooves the general practitioner to be able to make certain tests as to the refraction and accommodation in all doubtful neurotic cases, when the symptoms point at all to strain of the ocular muscles. There is nothing absolutely new, although this is often forgotten, in the claim that serious constitutional symptoms are sometimes relieved by the proper correcting glasses. One of the believers in the very great value of correcting glasses and operations upon the ocular muscles, in many forms of constitutional disease, inquires* "if an irritation originating in an injured or degenerated eye may also give rise to disturbances in distant organs—for instance, the heart, the kidneys, or the muscles of the extremities," and he answers this inquiry in the affirmative, and cites illustrative cases which are thought to prove this. Neuralgia, insomnia, and epilepsy are diseases which the writer just quoted enumerates as those which may be caused by "difficulties in performing the function of sight."

Mr. Bendalack Hewetson, of Leeds, England, has published a number of striking cases of relief from sick headache by the use of atropine and the correction of astigmatism.

Noyes, Galezowski, Weir Mitchell and others long since wrote on the bad constitutional influence of "eye

*Transactions of the International Medical Congress, London, 1881, vol. iii, p. 112.

strain," but they do not go so far as Dr. G. T. Stevens, from whose paper I have just quoted.

Some years ago I knew very intimately a young physician, of neurotic parentage on both sides, who suffered severely at times from "blind headaches"—headaches that impaired his sight seriously for a short time, and made him very ill for 24 or 36 hours. He had no disease of his eyes beyond a slight degree of latent hypertropia. After this had been corrected, and while he was wearing glasses, for a year the headaches were very much less frequent. He finally gave up his glasses, and the headaches did not recur, but he was always rather feeble, and at last broke down and died from a series of affections, of which Bright's disease was one. His case illustrates what I mean when I state my conviction that defects of sight are only one, and sometimes only a temporary, factor in the production of neuroses. Too much stress should not be laid upon the curative power of the correction of errors of refraction, or we shall often meet with cases that we can with difficulty reconcile with theories of their sole influence or that of a want of equilibrium of the ocular muscles. I have known several celebrated people who have done good work without glasses, and without ocular treatment, whose eyes were never in a state of equilibrium.

The claim that a large proportion of the neuroses are due to the eye is a larger one than that made by Donders when he issued his book. He

recommended glasses for hypermetropia, astigmatism, asthenopia, as well as for myopia and presbyopia, and Graefe made great use of prisms for the correction of muscular asthenopia dependent upon insufficient power of the internal recti, but neither of these men appears to have dreamed of glasses as a panacca for headaches, dyspepsia, epilepsy, chorea, or uterine diseases, for all of which they are now in some instances advised. Donders went very far in his statement that "hypermetropia is usually at the bottom of asthenopia." But his definition of asthenopia was a narrow one compared with that now often employed . It was confined to "a feeling of fatigue and tension, ... especially above the eyes," with "indistinct and confused vision in reading, writing, and other close work." It is hard to overestimate the value of Donder's work in tracing the frequent source of asthenopia to hypermetropia. He stopped such practice as division of the external recti to relieve what was supposed to be spasmodic contraction of these muscles. His investigations have permitted thousands of young people to become educated men and women—young people who, before the days of convex glasses for hypermetropia, were condemned to sheep grazing and cattle ranches, without the benefit of light reading. He was even conservative in the face of his great discoveries, and did not recommend glasses even to "an elegant lady of 22," under treatment for slight granulation, who had a painful hyper-

metropia requiring a glass of 24 inches focal power for its correction, and he heads her case: "Hypermetropia does not always cause disturbance, and correction is then unnecessary." He details with a graphic pen an account of a reverend asthenope of 52 who has a "sad past and lives in a gloomy future," who, from fear of blindness, has not contracted a matrimonial alliance with which he believed his happiness for life to be connected—a man who left him as "one saved from destruction" by a change of glass of 20 inches focal distance to one of 7. He also carefully draws the line between apparent and true asthenopia, and pictures a nervous, weak little woman of 33 who can not use her eyes, and yet who is not relieved by glasses. In spite, however, of Donders' scientific reserve in statement, I fancy that many an oculist since his time has been disappointed in finding that he has not been able to cure the asthenopia which accompanied hypermetropia by convex glasses alone, although he has proved that the refractive error was at the bottom of his case. In other words, although Donders does not appear to have had a glimmer of light that was to be thrown over all the domain of reflex nervous disease by a study of errors of refraction and weak interni, we do not always find even his moderate statement of the curative power of glasses sustained in every case; but I am not at all sure but that Donders has conferred as great a material blessing upon the human race in

teaching us fully as to the use of convex and cylindrical glasses as was ever conferred by one man.

One of the sources of deception of those who expect too much of glasses, is found in the fact that there is a class of patients who invariably are relieved by any *new* treatment, and fondly imagine that the last remedy is to relieve them of symptoms that are sometimes constitutional and inherited, and from which there can never be anything more from our science and art than palliation. Neurotic they are born, and neurotic they will continue to be as long as they continue to live. Much as glasses have done for mankind, and much more as they will do, they by no means furnish a panacea for the ills of human existence.

A person suffering from headaches, chorea, epilepsy, or any other disease likely to be remedied or mitigated by glasses, will usually get great benefit from full paralysis of the accommodation by the use of the sulphate of atropia.

The practitioner, however little he may know about the tests for the correction of imperfect vision, or for weak ocular muscles, may easily get a good idea of the probable value of glasses by this simple procedure: The worst cases of spasm of the accommodation may be usually relieved by the instillation of a four-grain solution of the sulphate of atropia, into each eye, three times a day for a week, and generally, three days is sufficient.

Those who see much of diseases of the nervous system would do well to avail themselves more frequently of this simple test by atropia. The use of atropia in this way, is the only means known of putting the eye at rest. The value of rest as a therapeutic agent is probably never overestimated.

CASES ILLUSTRATING THE VALUE OF GLASSES AND LIMITATIONS IN THEIR VALUE IN RELIEVING VARIOUS SYMPTOMS.

CASE I.—*Pain in the back part of the eye on use for near objects.*

J. H., æt. 23, a book-keeper. For five or six years his eyes have troubled him. For two years he has worn convex glasses. He is a well-developed young man, in good health, except that he has "malaria" in the spring. He makes the peculiar complaint that the back part of his eyes gives him pain when he walks. When he takes off his glasses he has pains in his eyes and dizziness. Under the use of atropine, it was found that a glass of twenty-four inches focal distance was required to make him see $\frac{20}{20}$. A glass of thirty-six inches focal distance was ordered. A faradic current of electricity was employed about and over the eyelids two or three times a week for about two months, and the troublesome symptoms disappeared.

This may be said to be a typical case of insufficient relief from glasses alone, although there was

considerable hypermetropia. A faradic current of electricity, with generous doses of moral suasion, brought this young man up to his work with his eyes. He had been using glasses that fully corrected his hypermetropia, and a change was made to those allowing a little more of his accommodation to be employed. This may have had something to do with the result, but not very much, if any, for he did not get immediate relief.

CASE II.—*Frequent Winking the Chief Symptom.*

M. B. W., aged nineteen, clerk. He is confined all day in-doors as a salesman in a country town. His vision was found to be normal, and all glasses caused a blur. He was put upon the use of arsenic, and advised to be more in the fresh air, but after a month he was not materially better. His ciliary muscles were then paralyzed by the use of atropine. After some days the refraction was found to be hypermetropic ($\frac{1}{30}$ in the right eye and $\frac{1}{42}$ in the left). He was advised to wear convex glasses, and, after a short time, the frequent winking of the eyes was completely relieved.

This is a case where it is probable that even a low degree of hypermetropia caused a spasm of the accommodation and the frequent winking. Such a person, employed out-of-doors, would probably have had no trouble with his eyes, and yet it would have required much longer for the relief of his symptoms by general treatment alone than was needed when the

correcting glasses were employed, and the strain upon his accommodation greatly lessened. This patient will probably in time give up wearing glasses until presbyopia occurs.

CASE III.—*A Seamstress suffers for Years, at more or less Regular Intervals, with Severe Neuralgic Headaches; Complete Relief after Use of Cylindric Glasses.*

Mary L., aged twenty-six, has suffered as above ever since she began to use her eyes constantly. It was suggested to her that her eyes might be the cause of the trouble. Her vision was found to be $\frac{20}{70}$. Under atropine, mixed astigmatism in one eye and myopic astigmatism in the other were brought out, and with glasses (R. E. $+ \frac{1}{36}^{c}$ 90° $- \frac{1}{48}^{c}$ 180°, L. E. $- \frac{1}{48}^{c}$ 180°$- \frac{1}{48}$) her headaches disappeared

This case has been observed for three years, and the relief afforded has been very great. It will be observed that the defect in vision is great, and that the refraction of the eyes is is very dissimilar. I think the practitioner who hopes to cure headaches by the use of glasses, will be disappointed if he starts out with the idea that he may accomplish much unless there is a marked departure from the normal in the visual power. A slight degree of hypermetropia is a normal condition, if we exclude myopes, of the civilized human races. It cannot be believed, then, nor do statistics show, that headaches are often relieved where there is found, when the ciliary muscle is fully

paralyzed by belladonna, only a low grade of hypermetropia without astigmatism.

A sister of the above described patient has similar eyes, and has had similar benefit from properly adjusted glasses.

CASE IV.—*A young Woman engaged in Coloring Photographs has Distorted Vision and Asthenopia in Close Work; Glasses give only Partial Relief.*

Miss X., aged twenty-three. For two or three years the patient has had much trouble in using her eyes. She has pains and confused feelings in her head. Glasses were fitted to her eyes by a competent surgeon, but she still suffers much. She has had much trouble from being reduced in fortune and from unhappiness in her home. She has myopic astigmatism in each eye, and very slight insufficiency of the interni at twenty feet. She also suffers from uterine displacement, for which she is under the care of a gynæcologist. Great pains were taken to adjust the proper glasses, with which her vision is raised from $\frac{20}{50}$ to $\frac{20}{20}$, but she struggles along with her work with difficulty.

If the source of this young woman's headaches and diplopia was solely in her eyes, our task would be an easy one. But here we have over-work and worry and uterine disease, any one of which is sufficient, without myopic astigmatism, to cause headaches or diplopia. Here we must needs "minister to a mind diseased" and "raze out the hidden trouble of the

soul," besides our adjustment of glasses. Even if we concede that uterine disease may be caused by an error of refraction or an insufficiency of the interni, it certainly would be still difficult to conceive that worry from being obliged to work for one's living, instead of living at ease, was produced by the same cause.

CASE IV.—*Sick Headaches; Hypermetropia of High Degree; no Relief from Glasses.*

Mrs. A., aged forty-three. She has suffered from sich headaches for years, as have other members of the family. She has worn glasses for years, but the headaches recur. Her vision is $\frac{20}{20}$, but, although only just presbyopic, she requires a glass of sixteen inches focal distance to read No. 1 Jaeger at 8". She has no insufficiency of the interni, no astigmatism, and is a married woman, sterile, but apparently in robust health, and has been for years.

Plainly some other cause than hypermetropia must be found for this case. Glasses will not cure it.

CASE VI.—*A Blow upon the Head is followed by Nausea, Headache, and Asthenopia; Hyperopic Astigmatism discovered; Gradual Relief.*

Miss R., aged thirty-one, artist in oil-colors. This patient struck her head against a shelf—the top of her head—some two months before she consulted me, in September, 1883, and she states that she had nausea and headache at once, and since then she has been unable to use her eyes at close work. The blow was

upon the left side of the head, about two inches from the median line and about four inches above the eye. Her physician writes me that she has been anæmic and hysterical, and, although he detected hyperopic astigmatism and adjusted glasses, her eyes are no better, although her general condition has improved. I confirmed the diagnosis, and, after a course of some months' rest, tonics, and general care, with use of her glasses, she gradually became able to again do a fair amount of work.

This certainly is a mixed case. With a basis of general anæmia, a blow precipitates an attack of asthenopia. Galezowski described such cases some years since. Under atropine she had hyperopic astigmatism, compound on one side ($+\frac{1}{60}^{c}$ 90° = + 72); on the other, simple hyperopic astigmatism $+\frac{1}{48}^{c}$ 90°; but, without atropine, her vision was $\frac{20}{20}$, and she always "saw better," as she said, without her glasses than with. No doubt the astigmatism and spasm of the ciliary muscle were ætiological or predisposing factors in this case, but they were factors only. Much was needed for her relief besides the adjustment of glasses.

Caso VII.—*A lawyer suffers from asthenopia; partial relief from prisms, still greater from cylindric glasses and electricity.*

Mr. M., æt. 35, has been seen more or less for two years and a half. Has had asthenopia for five years. He is wearing a cylindric glass, with a prism

of 2° base inward, before each eye, but with imperfect relief. He is in good health and vigor. He has insufficiency of the internal recti of 5° by Graefe's test. His eyes were put under the influence of atropia, and glasses fully correcting the compound myopic astigmatism were advised, as well as the use of the faradie current of electricity about his eyes once a day. The severe symptoms finally subsided, and December 22, 1885, he reports that he has a fair and painless use of his eyes, but that he occasionally finds need to make use of electricity.

This is not the only case where I have found that the combination of prisms with the correcting glasses did not seem to do as well as a full correction of the myopia. I confess that I use prisms less and less, for I find that a very considerable degree of insufficiency of the interni is not consistent with good vision without asthenopia.

Case VIII.—*A lady has frequent headaches as long as she can remember; blepharitis ciliaris, myopic astigmatism; great relief from glasses.*

Mrs. R. L., æt. 28, is a large, well-developed woman. She has three children. She has suffered from frequent headaches of a severe character since she was a child, and her eyelids present an unsightly appearance from inflammation of the hair follicles. She was found to have myopic astigmatism (R. E. — $\frac{1}{24}$ — $\frac{1}{18}$ c 10°; L. E. — $\frac{1}{12}$ — $\frac{1}{60}$ c 170°). Glasses were adjusted; the lashes were treated with bicar-

bonate of sodium and ointment of red oxide of mercury. For two years and a half she has had scarcely a headache, as she says, and her eyelids, which have been red since she had the measles at three years of age, are free from hyperæmia and retained secretion.

In 1876* I attempted to show that blepharitis ciliaris was usually, if not always, accompanied by errors of refraction, and that its cure or relief were greatly facilitated by their correction. Ten years of observation have confirmed this view to my mind, and I believe it is now quite generally accepted. In this case, as in so many others, local means without resort to glasses had been tried in vain. The relief of the headaches is now even more marked than the cure of the inflammation of the lids. One of the children of this lady also has a decided error of refraction, and also blepharitis. It will be interesting to note if headaches also occur.

Case IX.—*Compound myopic astigmatism in each eye in a school-girl; good vision secured with glasses, but only partial relief from asthenopia.*

Alic M., æt. 16. For three years this patient has been under the care of Dr. Emerson and myself, and, although we can find no adequate cause for the asthenopia, and glasses are fitted so as to raise her vision from $\frac{20}{100}$ and $\frac{10}{100}$, R. and L. eye respectively,

---

* Transactions of the International Congress of Ophthalmology," New York, 1876.

she gets but partial relief. Her general health is good; the menstruation and bowels are regular.

It is, of course, possible to suppose many things as at work in this case to produce a satisfactory result. It may be a progressive myopia with attendant inflammation, and other possible causes will suggest themselves to my readers. Yet the case is substantially no different from many in which relief follows the use of glasses and general hygiene.

CASE X.—*Hypermetropia of a considerable degree; opacity of the capsule of the lens; no relief from glasses.*

Mrs. L. A., æt. 21. For a few months this patient has complained of a spot before the right eye and of mistiness of vision. For a month she has not been able to use her eyes without pain. She is in good general health. She has no insufficiency of the internal recti muscles. Her vision is only $\frac{20}{40}$, and becomes $\frac{20}{20}$ by the use of convex cylindric glasses. A minnte opacity of the posterior capsule of the lens is found with ophthalmoscope. Her eyes were put thoroughly under the influence of atropine, when the astigmatism disappeared, but quite a high degree of hypermetropia ($\frac{1}{20}$) appeared, and vision became $\frac{20}{30}$ +.

This case is of some interest, as showing that there may be a spasm of the ciliary muscles in which one part of this ring of muscular tissue is more involved than the other, for an astigmatism of $\frac{1}{48}$ gave

way on full relaxation to hypermetropia. After a fair trial for more than a year, this patient declares that her eyes are no better. This failure to give relief is perhaps due to some inflammatory process too subtle to be observed by the ophthalmoscope, yet indicated by the slight capsular opacity. It is quite common, however, especially in hypermetropic eyes, to find a minute opacity on the anterior capsule—an opacity superficial in character, and looking like a bit of pigment from the iris glued to the lens.

Case XI.—*Asthenopia for thirty years in a nervous subject; compound hyperopic astigmatism; never able to use his eyes without discomfort.*

A. B., æt. 36, merchant. He states that his eyes have given him trouble ever since he began to use them. He has always had an aversion to using them. He is a well-developed, healthy-looking man, but he is pre-eminently nervous. He can scarcely sit still in a chair for half a minute. He has been wearing a convex glass for reading for ten years. The vision in the right eye is $\frac{20}{40}$, and in the left $\frac{20}{100}$. During an ophthalmoscopic examination the patient acts like an hysterical person. His eyes were put freely under the influence of atropine. Compound hyperopic astigmatism was found in each eye, but no other affection. He was advised to wear correcting glasses, both for distance and for near objects. He finally was able to use them all the time in-doors in reading and writing. For about six weeks I received weekly letters from

this patient, who resides in Chicago, stating that he never could wear his glasses, but finally he settle down and said he was used to them.

I can not but think that cylindric glasses would have materially assisted this patient's vision years before. But I cannot believe that his nervousness was caused by the astigmatism, and I look for no relief from this constitutional condition. He was born neurotic, and neurotic he will die. I have seen one patient who suffered from well-marked chorea at one period of her life—chorea which followed acute articular rheumatism—from which she recovered fully, and not until several years after was hyperopic astigmatism detected in one eye and mixed astigmatism in the other. This was corrected and great happiness bestowed upon her, but the glasses were not given until years after the recovery from the chorea.

Case 12.—*Dizziness and Double Vision in a Young Boy; Nearly Complete Recovery on the Use of Glasses* — Master H., æt. 12. Since he was a small child he has not been able to control the muscles of his eyes. He sees double when he looks at anything fixedly for five minutes. If he halts for an instant in reading, he sees double. His eyes pain on use, and he gets dizzy. His general health is good, but when the dizziness comes on he is often nauseated. His vision is found to be $\frac{20}{100}+$ in the right eye, and nearly $\frac{20}{20}$ in the other. The diplopia is crossed, showing insufficiency of the *recti interni*. After being some five days under

atropine, he was found to be myopic in the right eye and emmetropic in the other. But no glass brought his vision up to more than $\frac{20}{50}$ with the right eye. A month after a 1 to 25 D. glass had been ordered for the right eye and a plane one for the left. He reported that he had no dizziness or double vision unless he took off his glasses.

It is notoriously difficult to manage cases of asthenopia in which the refraction of one eye is markedly different from that of the other, and yet not every person with *anisometropia* has acthenopia. Many persons get on very well with one myopic and one hypermetropic eye. It is also remarkable how much may sometimes be done in causing the eyes to work together without difficulty. A patient of Dr. Loring's, a bar-tender, was known to wear a strong convex glass on one side over an eye from which the lens had been removed, and a strong concave glass on the other. He had some difficulty in learning how to mix drinks and to walk down-stairs, but he finally succeeded after pouring many mixtures over his bar and nearly breaking his nose from various falls from a misstep.

Case 13.—*Asthenopia for many Years; under the Care of many Oculists, but no Relief sufficient to enable her to read and sew; Hyperopia in One Eye and Myopic Astigmatism in the Other.*—Mrs. L. B., æt. 38. This patient is neurotic and anæmic. After many trials under atropine, I advised a glass for each eye. The vision could be made $\frac{20}{30}$ in the right eye from $\frac{20}{40}$, and

$\frac{20}{40}$ in the left (R. E. + $\frac{1}{20}$; L. E. + $\frac{1}{48}$ — $\frac{1}{24}$ c 165°), and electricity was used, but, like all my predecessors, I failed to enable her to use her eyes after a trial of some months.

Case 14.—*An Unsteady Head Relieved by Glasses.*—R. K., æt. 44, lawyer. He states that he has had an "unsteady head" for some two years. He has been treated by various physicians without relief. His last physician advised him to have his eyes examined. He can give no clearer account of his symptoms than to say that his head is unsteady. He does not walk easily, from fear of vertigo. He appears to be in excellent health, and gives no history nor appearance of constitutional disease of any kind. His vision is $\frac{20}{30}$ in the right eye and $\frac{20}{20}$ in the left. He is found to have hyperopic astigmatism in each eye. He has insufficiency of the internal recti of 6° for the near. He was ordered correction glasses. His symptoms were at once relieved, and, five months after, his wife reported to me that he was wearing his glasses, and that he was almost entirely free from all unpleasant symptoms.

Case 15.—*Asthenopia in a Nervous Man; Considenable, but not Complete, Relief from Prisms.*—L. K., æt. 28. He states that for the past two years he has been unable to use his eyes at close work, for any considerable length of time, without having a very disagreeable sensation in his head. His sight very seldom blurs. He is in active business, and his gen-

eral health appears to be good. He is, however, a subject who dwells much upon his physical ailments, and evidently is a neurasthenic person. He has consulted several oculists. He has latent hyperopic astigmatism. Without atropine, he accepts no glass before one eye, and a concave cylindrical before the other. His recti-interni muscles are weak. He was told to continue the use of convex glasses with prisms, about as ordered by his last adviser. He was seen several times, and, on the whole, is doing well, although he is apparently morbidly conscious of his eyes. He wears a plane glass, with a prism of 3°, base inward, before each eye when walking about, convex cylindrical glasses for reading, etc.

This patient has a brother, who was also seen by Dr. J. B. Emerson and myself, in consultation with his physician, who suffers from nervous irritability and insomnia. He also has been under the care of an ophthalmic surgeon, who, as he states, considers his head symptoms due to his eyes. This patient's sight is defective from lenticular opacities, although he is but 44. He gets but partial relief from glasses, but he was much better after a summer trip abroad. To my mind, these are typical cases of neuroses, in which there is no hope for perfect relief from any kind of treatment directed to the eyes alone, although something may be done in that direction, even in the brother with the circumscribed opacity of the lens. A study of the ancestry of these two brothers would, I

think, throw some light upon their neurotic dispositions.

Uterine asthenopia, or the asthenopia so often found in women suffering from serious uterine disease, I have never been able to materially alleviate. Neither have I seen any benefit, other than very temporary, in the correction of trifling errors of refraction in neurotic hysterical subjects, nor in the weakness of ocular muscles, so often one of the early symptoms of locomotor ataxia. Their neurotic maladies fly from one part of the body to the other. They locate their diseases first in one organ and then in the other. One of them, who was boasting of the cure of his eyes by his last oculist, when so many before him had failed admitted that, while his eyes were all right, the "disease had gone to his stomach." Cures of such patients depend very much upon the mental characteristics of the attending physician as well as of the patient. If the former is a sentimental optimist, with great faith in remedies, not scrupulously objective in his examination, and if he deals with feminine patients, or male patients with feminine characteristics, he will score many temporary successes, when a cool-headed practical surgeon, accustomed to believe very little, will fail from the start. Much depends, in the estimate of a cure of neurotic subjects, on the point of view. That glasses will cure organic disease, or that the want of them will allow it to occur in parts remote from the head, I am not yet prepared to believe, and

yet errors of refraction and accommodation are sometimes the cause of serious functional disturbances beyond those of vision; still, hypermetropes may live to become presbyopes without asthenopia. Only when the failure of accommodation occurs from senile decay will they become aware, by the need of very strong convex glasses for close work, and the failure of distinct vision also, that they started in life with eyeballs of less focal power than many of their fellows. Some myopes go through life without ocular symptoms, while a long eyeball in others becomes a prolific source of evil, and finally leads to that apalling disaster, detachment of the retina. Thus I might go on. Our imperfect knowledge as yet does not always enable us to say what are all the factors in a given case of disease. That there are often many, and seldom one alone, is scarcely to be denied. A narrow specialism will never find any comfort in the study of the woes of the human body. The various causes of disease are too complex and concealed in very many, if not in the majority, of cases to be found in the abnormal condition or action of one organ. While the correction of errors of refraction and accommodation, and the unburdening of overloaded ocular muscles, will do much to alleviats the asperities of human existence, these things are not as yet a panacea even for neuroses, much less for inflammatory diseases. In our hopes for cure in employing these methods, we still

require to avoid skepticism on the one hand and excessive confidence on the other. *Medio tutissimus ibis.*

A part of the foregoing chapter was read before the New York Academy of Medicine in March, 1886, and published in the N. Y. Medical Journal, vol. xvi., No. 11.

THE DIOPTRIC SYSTEM OF MEASURING THE FOCAL POWER OF GLASSES, AS COMPARED WITH THE OLD SYSTEM OF MEASURING THE FOCUS BY INCHES.

In this old system of measuring the focal power of lenses, the inches of the various countries were made the standard. A strong lens was taken as the unit. A convex glass of one inch focuses parallel rays at one inch, one of ten at ten inches, and so forth. For the sake of convenience fractions are employed, and a glass of ten inches focal distance is called $\frac{1}{10}$. For many reasons it has been thought advisable, if possible, to introduce a uniform method for all countries, which would be impossible so long as the inch is the unit, differing as it does in different countries. In the new or dioptric system, the unit is a weak lens of one metre focal length. This is called a diopter. The numbers of glasses by the old system really indicate the radius of curvature of the surface of the lens, and not its exact refractive power. The great objection to these lenses, however, is the fact

that the addition and subtraction of lenses leads us into somewhat difficult problems in fractions.

In the new or decimal system this latter difficulty is fully overcome. The addition and subtraction of lenses becomes very easy. A diopter, having a focal distance of one meter is the unit. One meter = 39.-3708 English inches. The cases containing trial lenses are now generally arranged on the dioptric system, although the equivalent in English or French inches is also given. The glasses begin with a quarte of a diopter, 0.25, and run up to 20 diopters. To illustrate the convenience of the new system we have only to take a patient with hyperopia who has become presbyopic. His hypermetropia is, we will say, 0.75 D., or ¾ of a diopter, he is 42, and his presbyopia requires about the same glass, which is equivalent to one of 49 English inches. If we add together the two ¾ of a diopter, we shall have 1.50 diopters, the glass he will need for reading—a much simpler operation than to add together two fractions like $\frac{1}{49}$. Those who once employ the new system will not readily, I think, return to the old, although the latter is still widely employed in this country and in Great Britain.

JAEGERS TEST-TYPES.

No. 1.

The Gallic tribes fell off, and sued for peace. Even the Batavians became weary of the hopeless contest, while fortune, after much capricious hovering, settled at last upon the Roman side. Had Civilis been successful, he would have been deified; but his misfortunes, at last, made him odious in spite of his heroism. But the Batavian was not a man to be crushed, nor had he lived so long in the Roman service to be outmatched in politics by the barbarous Germans. He was not to be sacrificed as a peace-offering to revengeful Rome. Watching from beyond the Rhine the progress of defection and the decay of national enthusiasm, he determined to be beforehand with those who were now

No. 2.

his enemies. He accepted the offer of negotiation from Cerialis. The Roman general was eager to grant a full pardon, and to re-enlist so brave a soldier in the service of the empire. A colloquy was agreed upon. The bridge across the Nabalia was broken asunder in the middle, and Cerialis and Civilis met upon the severed sides. The placid stream by which Roman enterprise had connected the waters of the Rhine with the lake of Flevo, flowed

No. 3.

between the imperial commander and the rebel chieftain.—Here the story abruptly terminates. The remainder of the Roman's narrative is lost, and upon that broken bridge the form of the Batavian hero disappears forever. His name fades from history: not a syllable is known of his subsequent career; everything is buried in the profound oblivion which now steals over the scene where he was the most imposing actor. The contest of Civilis with

No. 4.

Rome contains a remarkable foreshadowing of the future conflict with Spain, through which the Batavian republic, fifteen centuries later, was to be founded. The characters, the events, the amphibious battles, desperate sieges, slippery alliances, the traits of generosity, audacity, and cruelty, the generous confidence, the broken faith, seem so closely to repeat themselves, that history

No. 5.

appears to present the self-same drama played over and over again, with but a change of actors and of costume. There is more than a fanciful resemblance between Civilis and William the Silent, two heroes of ancient German stock, who had learned

No. 6.

the arts of war and peace in the service of a foreign and haughty world-empire. Determination, concentration of purpose, constancy in calamity, elasticity almost preternatural, self-denial, consummate craft in political combina-

No. 7.

tions, personal fortitude, and passionate patriotism, were the heroic elements in both. The ambition of each was subordinate to the cause which he served. Both refused the crown, although each, perhaps, contemplated, in the

No. 8.

sequel, a Batavian realm of which he would have been the inevitable chief. Both offered the throne to a Gallic prince, for Classicus was but the prototype of Anjou, as Brinno of Brederode, and neither was destined, in this

No. 9.

world, to see his sacrifices crowned with success. The characteristics of the two great races of the land portrayed themselves in the Roman and the Spanish struggle with much the same

No. 10.

colors: twice a Batavian republic took its rank among the leading powers of the earth.

No. 11.

Claudius Civilis was a Batavian of noble race, who had served twenty-five years in the

No. 12.

Roman armies. He was a soldier of fortune, and had fought wherever the Roman

No. 13.

eagles flew; after a quarter of a century's service, he

No. 14.

was sent in chains to Rome, and his brother