

ANOMALIES OF THE ACCOMMODATION CLINICALLY CONSIDERED.

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Considering the amount of attention devoted to refractive errors and their correction, the study of accommodative anomalies has received comparatively little attention from ophthalmologists. Yet those who deal day after day in their consulting-rooms with the problems of refraction work recognize, I am sure, that these anomalies often occasion considerable trouble, so that if we fail to diagnosticate and treat them, we are not doing our whole duty to our patients.

This neglect of an important subject has been due, we believe, not so much to a failure to recognize its importance, as to the fact that hitherto the precise data on which a satisfactory study should be based have been lacking. For it is evident that, before we can say what the symptoms of abnormal accommodation are, we must have a clear notion of what we mean by normal accommodation. In other words, we must, by defining the limits of normal accommodative action, determine when any given accommodation can be called subnormal or supernormal. Up to a few years ago extensive studies on this point were lacking.

This lack the author tried to supply by a series of researches which he has pursued for nine years, and reports of which have been made to this Society in 1908, and to the Section on Ophthalmology of the American Medical Association in 1910 and 1912. Contrary to the impression gathered by some, the main end of these researches was different from that sought by Donders and other predecessors in this field. These observers aimed to obtain a curve representing the

mean accommodation at each age. The author's curves and tables showed this, and, in addition, the maximum and minimum normal accommodation at each age from ten to sixty. As was pointed out in these papers, from these values, which were based on some 12,000* measurements made on 1500 cases, one could determine with fair certainty, as one could not from the values reported by preceding investigators, whether the accommodation in any given case was normal or not, and, if abnormal, how far it varied from the lower or upper normal limits.

The values obtained are shown in the table, page 388.

METHOD OF TESTING ACCOMMODATION.

The way in which this table is used is as follows: The patient whose accommodation we are testing is placed with his back to the light (good, diffuse daylight should be used when possible), and is directed to look sharply at the test-object (a fine black line bisecting a white parallelogram which is mounted on a disc of black velvet). The eye not under examination is covered, and the test-object is brought toward the patient along a Prince's rule until the fine line blurs, and then is carried back and forth several times until we ascertain the nearest point at which the line can be seen with perfect distinctness. The position of this nearest point on the rule indicates the accommodation in diopters.

In order to make the tests comparable with the table the measurement must be made from the anterior focus of the eye, *i. e.*, a point 13 mm. in front of the cornea, or, practically, from the plane of the trial-frame or the patient's glasses. Furthermore, the patient must either be provided with his full refractive correction or, if not, a corresponding allowance must be made in the reading found.

Repeated tests should be taken, and care must be exercised that the results are not vitiated by the patient's inattention

* Confirmed by some 3000 taken since.

**TABLE OF NORMAL VALUES OF THE ACCOMMODATIVE POWER
AT ALL AGES FROM 8 TO 68.**

Accommodation is given in diopters and tenths, near-point being measured from the anterior focus of the eye, *i. e.*, from a point 13 mm. in front of the cornea.

AGE	LOWER LIMIT IN NORMAL CASES	MEAN VALUE	USUAL UPPER LIMIT	EXTREME UPPER LIMIT
8	11.7	13.8	15.4	16.4
9	11.6	13.6	15.2	16.2
10	11.4	13.4	15.0	16.0
11	11.2	13.3	14.9	15.8
12	11.1	13.1	14.7	15.6
13	10.9	12.9	14.5	15.4
14	10.8	12.7	14.3	15.3
15	10.7	12.6	14.1	15.2
16	10.5	12.4	13.9	14.9
17	10.3	12.2	13.7	14.6
18	10.1	11.9	13.5	14.4
19	9.9	11.7	13.2	14.2
20	9.7	11.5	13.0	14.0
21	9.4	11.2	12.8	13.7
22	9.2	10.9	12.6	13.5
23	8.9	10.6	12.3	13.2
24	8.7	10.4	12.1	13.0
25	8.4	10.2	11.8	12.7
26	8.2	9.9	11.6	12.4
27	7.9	9.6	11.3	12.1
28	7.6	9.4	11.1	11.8
29	7.3	9.2	10.7	11.5
30	7.1	8.9	10.4	11.2
31	6.7	8.6	10.2	10.8
32	6.4	8.3	9.9	10.5
33	6.1	8.0	9.6	10.2
34	5.9	7.7	9.2	9.9
35	5.6	7.3	8.9	9.6
36	5.3	7.1	8.6	9.4
37	4.9	6.8	8.2	8.9
38	4.6	6.5	7.9	8.6
39	4.3	6.2	7.6	8.2
40	4.0	5.9	7.2	7.8
41	3.6	5.4	6.8	7.5
42	3.2	5.0	6.4	7.0
43	2.8	4.6	5.9	6.5
44	2.5	4.2	5.5	6.1
45	2.2	3.7	5.2	5.6
46	1.9	3.3	4.8	5.1
47	1.7	2.8	4.3	4.5
48	1.5	2.5	3.9	4.0
49	1.3	2.2	3.4	3.4
50	1.2	2.0	3.0	3.0
51	1.1	1.8	2.6	2.6
52	1.0	1.6	2.3	2.3
53	0.9	1.5	2.1	2.1
54	0.9	1.4	2.0	2.0
55	0.8	1.3	1.9	1.9
56	0.8	1.2	1.8	1.8
57	0.8	1.2	1.7	1.7
58	0.7	1.2	1.7	1.7
59	0.7	1.1	1.6	1.6
60 to 68	0.7	1.1	1.5	1.5

or lack of comprehension of what is expected of him. Care must be taken, too, that we do not consider as due to failure of accommodation blurred vision caused by insufficient illumination, uncorrected errors of refraction, opacities in the media, or retinal disease.* Quite often a very faint and hardly distinguishable central scotoma produces a condition closely simulating an insufficiency of accommodation.

If, now, in any given case, repeated tests, properly made, show that the accommodation lies outside of the normal limits given for a person of the patient's age (see table), we may characterize the finding as abnormal.

PRELIMINARY REPORT ON ABNORMAL ACCOMMODATION.

In the papers cited, and in one read before the New York State Medical Association in 1913,† the general character of the variations from the normal was indicated. The present paper aims to give a more precise description of these anomalies, derived from a study of some 170 cases. These do not include all the cases seen, nor is the study offered as being in any sense complete. It is, in fact, preliminary only.

Varieties of Abnormal Accommodation.—The abnormalities of accommodation that have been observed are as follows:

1. The accommodation may be persistently below the lower normal limit (*insufficiency of accommodation*).

2. Akin to this condition, and, indeed, often constituting one stage of it, is that in which the accommodation is normal in amount, but is sustained only with effort and soon gives out (*difficult or ill-sustained accommodation*).

3. There is difficulty or sluggishness in changing from one accommodative state to another (*inertia of accommodation*).

4. The accommodation in the two eyes is not the same (*inequality of accommodation*).

5. The accommodation lies persistently above the usual normal limit (*excessive accommodation*).

* For precautions to be observed, see the author's papers already cited.

† Jour. New York State Med. Assoc., December, 1913.

Insufficiency of Accommodation.—By insufficiency of accommodation we denote the condition in which repeated tests, made under proper conditions, show that the patient's accommodative power is distinctly and persistently below the normal lower limit for his age (see table). Obviously, also, a patient must be held to have at least a *relative* insufficiency of accommodation if his accommodative power, although above the minimum normal limit for his age, is persistently below his own lower normal limit, as shown by later tests.

Insufficiency of accommodation may be *intermittent* or *constant*, and *transient* or *persistent*. It may also present all grades in intensity. Insufficiency of very high degree (*paresis* and *paralysis* of accommodation) usually differs in origin and character from the moderate insufficiencies, and hence will receive separate consideration. On the other hand, difficult and ill-sustained accommodation differs in no essential way from insufficient accommodation, and will be considered with the latter.

Frequency.—Insufficiency of accommodation is a fairly frequent affection. Precise statistics on this point are not forthcoming as yet, but the opinion may be hazarded that the condition occurs in at least 5 per cent. of our patients.

The following table shows the results as regards sex and age incidence:

AGE	SEX			
	Including all Occurring at a Given Age		Excluding those Counted Twice (i. e., Carried on from a Previous Age)	
	Male	Female	Male	Female
10-14.	3	5	3	5
15-19.	17	5	17	5
20-24.	10	12	8	11
25-29.	9	6	8	6
30-34.	14	6	12	6
35-39.	6	14	3	14
40-44.	6	16	6	13
45-49.	6	..	5
	65	70	57	65

The number of cases (122) is too small to warrant sure conclusions, but the following are offered tentatively:

Accommodative insufficiency is not very common before fifteen nor after forty-five. Between fifteen and forty-five it is about as frequent at one age as at another.

From puberty until twenty it occurs three times as often in males as in females.

From twenty to thirty it is about equally frequent in the two sexes.

Between thirty and thirty-five it is about twice as frequent in males. After thirty-five it occurs about three times as often in females as in males.

Types.—Insufficiency of accommodation may theoretically be due either to undue rigidity (accelerated sclerosis) of the lens or to weakness of the ciliary muscle.

We believe, from our observations, that both types actually exist and can usually be distinguished. In the former type, which may properly be called premature presbyopia, and which represents simply a physiologic process carried to an undue degree, the accommodation drops in much the normal fashion from year to year, but in any one year is always below the normal standard. The curve of descent, in other words, parallels the normal curve, but at a lower level.

In the type due to anomalies of ciliary action the insufficiency, being due to pathologic conditions which are themselves variable, varies from time to time, often in a quite haphazard manner, so that the curve of descent exhibits irregular sinuosities and salients. After sinking below normal it may become normal again, which would not be the case in a simple premature presbyopia.

In all probability also mixed cases exist, in which an insufficiency due to impaired ciliary action is added to an insufficiency due to premature sclerosis. These will present the characters of both types.

Associated Muscular Conditions.—It would naturally be

supposed that an insufficiency of accommodation, in which the patient is striving hard to see at near points, would be associated with an undue effort of convergence, *i. e.*, with convergence excess. But this association occurred in only a small minority (about 12 per cent.) of our cases.* Much more frequent was the association with an often marked, but sometimes transient, convergence insufficiency (about 44 per cent. of the cases). In some 10 per cent. other motor anomalies were present, and in about 34 per cent. the exterior muscles were normal.

Etiology.—The causes underlying accelerated sclerosis of the lens, and producing simple premature presbyopia, are, so far as we can tell, unknown.

The causes giving rise to ciliary weakness and causing the second (pathologic) type of accommodative insufficiency have in our cases been as follows:

1. Toxic conditions due to infectious disorders (intestinal toxemia, tuberculosis, influenza, whooping-cough, measles, tonsillar and probably dental infection).

2. Nasal obstruction: this appears to be a frequent cause, especially in the cases associated with convergence insufficiency.

3. Hypopituitarism and other disorders of the internal secretions.

4. Neurasthenia and anemia, brought on by overwork, impaired nutrition, and similar causes. These cases, too, are prominently associated with convergence insufficiency and sometimes with contracted visual fields.

5. Vascular hypertension: it is striking to find how often, in our notes, even in the case of young people, occurs the statement "vessels engorged and tortuous, arteries sharp, discs much injected." With this condition of things or with-

* In these cases of accommodative insufficiency with convergence excess there may be a spasm of accommodation. In other words, the ciliary muscle, weak as it is, may still act in a spasmodic sort of way, just as it does sometimes when partially under the influence of homatropin.

out is found, so often as to indicate its etiologic importance, a persistent, diffuse or reticulate, dense injection of the conjunctiva, with sometimes follicular or other forms of swelling. These cases are specially apt to be associated with considerable burning and smarting from use of the eyes and with intolerance of light. It has seemed to us not improbable that some of the cases with marked irritative symptoms and photophobia might actually be due to the effect of light on the eyes. One case, at least, seemed to be directly brought on by exposure to electric light.

6. Eye-strain, without the other contributing factors, and apart from the injurious effect of light, is a probable but not apparently a very frequent cause.

Symptoms.—The onset may be sudden; even so, apparently, in simple premature presbyopia. In more cases probably the onset is gradual.

The main symptoms are asthenopia—either simple tiring of the eyes or tiring associated with eyeache (sometimes of great severity), with marked irritation and burning of the eyes or with headache; blurred vision, especially for near work; vertigo; aprosexia; photophobia (quite a marked symptom in a number of cases). These symptoms are often due in part to the causal or associated conditions. Thus, the blurred vision at near points and the vertigo are often due to an associated convergence insufficiency or other muscular trouble; the irritative symptoms, to the conjunctival congestion so often present; and the photophobia, to this cause or to the retinal congestion.

An occasional finding, especially in the cases with marked convergence insufficiency, is a concentric contraction of the visual field.

The intensity of the symptoms varies greatly. In many cases they are such as to render eye work almost impossible. On the other hand, especially in simple premature presbyopia, the only complaint may be of impaired vision for near,

which is remedied at once by suitable addition to the glasses for reading.

Course and Duration.—The course and duration naturally depend on the cause. Recurrences may take place, sometimes at long intervals. In simple premature presbyopia the course goes on much as in an ordinary presbyopia, but the necessity for the use of an additional glass for reading begins much earlier—at forty or before.

Treatment.—The treatment is directed to the cause, whenever we can discover the latter. The removal of toxic conditions by remedying an intestinal indigestion or a dental or tonsillar infection; the relief of anemia and malnutrition by the use of tonics and proper diet; the regulation of vascular anomalies; the removal of nasal obstructions; treatment addressed to abnormal glandular conditions—all these are to be employed when required.

Eye-strain naturally should be relieved by proper glasses.

An associated conjunctival injection should be treated with zinc or other astringents.

For the insufficiency itself the following means should be tried:

1. For the blurred vision at near, the distance glass should be supplemented by a proper addition for reading (presbyopic correction for an unnatural presbyopia).

2. Even when the vision is not much blurred, this presbyopic addition may be necessary, especially if there is an associated convergence excess.

3. The accommodation may be stimulated directly by means of reading exercises, or, as I have found useful, by systematic exercise with the fine test-object (line) used in measuring the accommodation. The exercise consists in approximating this to the eye until it blurs, and repeating this manœuvre several times, trying each time to bring the line closer and force the eye to accommodate on it. Such exercise can be done two or three times daily.

4. Especially in cases associated with convergence insufficiency it is useful to stimulate both accommodation and convergence by systematic exercise with prisms, bases out, when the eyes are directed at a near object. This is supplemented by practice in converging both eyes on a dot which is brought closer and closer to the eyes until it doubles. These combined exercises are a very considerable help in many cases.

5. The use of pilocarpin as a stimulant to the weak ciliary muscle has not seemed to me of much avail in these cases.

Paralysis of Accommodation.—There is no hard and fast line between paralysis and insufficiency of accommodation. Any insufficiency of considerable amount may be called a paresis, and one that is complete or nearly so, a paralysis. The terms paresis and paralysis are specially applied to marked insufficiencies of sudden development, and either of toxic origin or due to organic lesions of the nervous system. But this is a distinction hard to draw and maintain.

In the great majority of cases paralysis of accommodation is due either to poisons (cycloplegics) or to syphilis and its sequelæ (tabes, general paresis). Paralysis due to these conditions is too well known to require extended description. Of the syphilitic paralyses, it may be said that they are late and very intractable manifestations, of evil prognosis, and yielding little or not at all to treatment, although they may disappear spontaneously and are then not infrequently replaced by paralysis of another kind. They are often unilateral, and are usually, but not always, associated with paralysis of the sphincter iridis.

Other causes that we have seen are:

1. Non-syphilitic disease of the central nervous system (one case). Condition relieved by drainage of cisterna magna, but recurring twice at long intervals.

2. Traumatism (two cases), both associated with parietic mydriasis.

3. Disorders of metabolism in growing boys (two cases, in one associated with almost complete paralysis of convergence.

4. Eye-strain produced by prolonged microscopic work, with voluntary dissociation of the eyes (one case), associated with complete paralysis of convergence.

No diphtherial paralysis was seen, although one would infer, from the text-books, that diphtheria is a frequent cause of accommodative paralysis.

In toxic and traumatic paralyzes the lesion is usually peripheral; in syphilitic and parasymphilitic paralyzes it is either peripheral, basal, or nuclear. The other types of paralysis are central in origin, and are, therefore, bilateral in character, and are not associated with paretic mydriasis.

A very peculiar picture is afforded by a combined paralysis of accommodation and convergence. In two of my cases the paralysis of both functions was almost total and lasted for months, after which the conditions returned to normal. The symptoms were total inability to use the eyes for anything but distant vision, diplopia increasing *pari passu* as the object looked at approached the eyes, and severe pain in the eyes, with, in one case, also marked headache.

The treatment of these conditions must necessarily be mainly causal.

Unequal Accommodation.—We sometimes find the accommodation unequal in the two eyes. Two reasons may be assigned for this inequality. Either the ciliary muscle may be weaker, or the lens may be more rigid in one eye than in the other. The former sort of inequality occurs quite frequently in ophthalmoplegia interior due to syphilis, tabes, traumatism, or poisons. It can be readily understood that these conditions may affect one eye more than the other, or may affect one to the exclusion of the other. Since in these cases the sphincter iridis and the ciliary muscle are usually affected simultaneously, the inequality in accommodation is

generally associated with inequality of the pupils—the eye with the weaker ciliary muscle having the larger pupil.

When not due to the causes above mentioned, unequal accommodation is usually not associated with inequality of the pupils. In this case, too, it may be caused by unequal action of the ciliary muscle. This was evidently the case in one of our patients, a man of thirty-one, in whom the accommodation in the right eye varied from 3 to 4 D., in the left from 5 to 6, and who also showed marked fatigue of the accommodation in the right eye. The causes here were obscure, but intestinal toxemia and dental infection were present. The symptoms were great asthenopia and a marked spasmodic convergence when he tried to use his eyes for near work.

Most of the other cases of this sort seem to be due to an unequal rigidity of the lenses in the two eyes. In other words, it is a form of presbyopia in which the sclerosis of the lens has advanced faster in one eye than in the other. Like simple premature presbyopia, it is probably a mere physiologic peculiarity, producing no symptoms until the accommodation in one eye or the other has sunk so low as to require the addition of a glass for near work. When this occurs, it is important to take account of the inequality and to determine by experiment whether we shall or shall not make an unequal addition for reading to the distance correction. Patients differ in this regard, some getting on better with such unequal addition, some without.

This condition of unequal presbyopia, or non-pathologic inequality of accommodation, is found mainly in patients between the ages of thirty-five and fifty.

Accommodative Inertia.—Accommodative inertia is the condition in which the patient changes from one accommodative state to another sluggishly or with difficulty. It is analogous to the slow adaptation that some eyes show in passing from light to darkness, or vice versa. It seems some-

times to be a source of real trouble. It is conceivably due to imperfect action of the ciliary muscle (ciliary inflexibility), and if so, might be relieved by accommodative and particularly by converging exercises. But it seems more likely that it indicates advancing sclerosis of the lens, in which case it would be a precursor to a fall in the accommodative power.

Excessive Accommodation.—Excessive accommodation, like insufficiency of accommodation, may be either ciliary or lenticular in origin.

A typical example of excessive accommodation due to ciliary overaction is the accommodative spasm produced by miotics, especially eserine. A similar, less violent action is set up naturally in some patients, causing them persistently to exaggerate a myopia or persistently to reject a hyperopic correction, in spite of continuous wearing. These cases of true spasm of accommodation may occur at any age up to fifty or even beyond. Such spasm may be associated with an actual weakness of accommodative power, and in any case is not an instance of real excess of accommodation.

Lenticular accommodative excess is the condition in which the accommodation is above the usual limit, because the lens is less rigid than ordinary. It is the opposite of premature presbyopia, and may be called delayed presbyopia. Whether, as would seem to be the case, it is always advantageous to have this overplus of accommodation, or whether the overplus may not sometimes indicate a pathologic state,* our observations have not so far enabled us to determine.

DISCUSSION.

DR. S. LEWIS ZIEGLER, Philadelphia: I should like to say a word concerning one phase of the subject discussed by Dr. Duane, namely, subnormal accommodation from obstructive lesions of the nose. I have a collection of these cases, which I hope to publish some day. I found that the

*In one case there were a number of peripheral, punctate, lenticular opacities, rather different in appearance from the ordinary arcus senilis lentis.

most common origin of this disturbance was due to contact-pressure between the middle turbinate and the septum, combined in some cases with a lesion in the sympathetic centers of the septal mucosa. There are other kinds of intranasal pressure that may create the same disturbance, but not so marked. We frequently find a variation in the power of the ciliary muscle. The loss of accommodation may be marked and improve, and then apparently take a second tumble, due entirely to the variable influence of the local lesion in the nose. Occasionally complete recovery occurs.

DR. LUCIEN HOWE, Buffalo, N. Y.: I think if we would take more time and care in examining these cases we would find accommodative insufficiency much more frequently.

I rise, however, to speak of the importance of observing the effect of "minimum" doses of atropin and of eserin. A discussion of this subject can be found in the recent reports made by the Committee on the Study of the Ocular Muscles in the Section on Ophthalmology of the American Medical Association. We know now that about 0.00013 gram is the minimum amount of atropin that will completely relax the accommodation of a normal eye within a given number of minutes. The pharmacists have already manufactured discs containing $\frac{1}{800}$ grain, and by making use of these we have this "minimum" dose which we can place on the conjunctiva. Then, after about twelve to fifteen minutes, the near-point in a normal eye begins to recede; or, if we represent the effect on a system of coördinates, as is usual, we find the curve then begins to fall and later continues to fall in a definite and regular manner, as was shown long ago by Donders. But, on the other hand, when there is insufficiency of accommodation, that curve is different. The fall then is quite rapid, as compared with the normal.

In a similar manner the action of a minimum dose of eserin gives important evidence as to the condition of the accommodation. We know that the minimum dose of this drug for the normal eye is from 0.000005 to 0.00001 gram. If we find that this amount does not contract the pupil within as many minutes as it does normally—in other words, if the curve is much longer than ordinarily—that alone is an indication of accommodative insufficiency.

DR. WILLIAM ZENTMAYER, Philadelphia: I wish to mention that for a long time I was quite skeptical as to the existence of unequal accommodative insufficiency. During a study of the accommodation, however, I found that it was of quite frequent occurrence. Perhaps that is an exaggeration; but it did occur not rarely, and cases that gave a great deal of trouble were relieved by carefully taking the near-point in each eye separately and, where the difference was marked, allowing for it in ordering the glasses.

I fear that our tests for taking the accommodation are not delicate enough to let us know exactly how much to allow. Very often the patient's judgment is poor in regard to the distinctness with which he sees the test-object, and we are led into adding too much or too little.

DR. G. E. DE SCHWEINITZ, Philadelphia: Inequality of accommodation is not of infrequent occurrence, and its determination and correction, in the relief of asthenopia, is a matter of importance.

I should like to confirm the statement of Dr. Duane regarding the frequency with which subnormal accommodation accompanies arteriosclerosis. Writing on the subject some years ago, I referred to certain types of asthenopia which one finds, especially in school-teachers approaching the presbyopic age, in association with high arterial tension. Correction of the vascular hypertension and correction of the subnormal accommodation secure the happiest result. I am satisfied that accommodative power, especially during earlier stages of "old sight," for example, between forty-five and fifty years of age, varies at different times of the day, and I am not satisfied in my determination of the glasses unless opportunity is afforded to compare measurements at different hours on several days. Time does not permit an elaboration of this statement, but the matter is worth investigation.

DR. A. E. DAVIS, New York: There is a certain class of accommodative insufficiency that I should be obliged to have advice as to how to handle; that is, where vision is absolutely perfect for distance, especially the early presbyopes, where there is no convergence insufficiency or excess, where there is orthophoria, and yet the patient is not able to use

the eyes five minutes at a time for reading. I have found this condition in Wall Street people who have been on a nervous tension. In this class, under the best general treatment, so long as they persist in this work, which entails so much nerve strain, I have been unable to give relief for near work. For distance they may have perfect vision, and yet when it comes to using their eyes for near work they cannot persist for as much as five or ten minutes.

As regards unequal accommodative power, I have a patient in whom the inequality amounts to one full diopter, and this correction has been worn for a number of years. The optician, noticing the difference between the two bifocal segments, called me up to be sure that I had not made a mistake. The patient is absolutely comfortable with that marked difference in the reading glasses.

DR. WARD HOLDEN, New York: I should like to ask Dr. Duane how much the maximum difference in the presbyopia of the two eyes may be. I frequently find a quarter of a diopter. There is that difference in my own eyes. I have rarely had occasion, however, to make a difference of more than that in the correction of the two eyes for presbyopia.

DR. ALEXANDER DUANE, New York: In regard to the matter of unequal accommodation in presbyopia, I think that it is one to which we have to pay, and should pay, a great deal of attention. It is not very often that we have to make a difference in the correction, however. Answering Dr. Holden's question, I would say that only occasionally do we find as much difference as a diopter, but we do find it sometimes. A persistent difference between the accommodation of the two eyes is probably due to the fact that one eye has become more presbyopic; that is, lenticular sclerosis has advanced faster in it than in the other. In these cases, even with a difference of 0.50 or 0.75 D., it does not always follow that the patient will accept a corresponding difference in the presbyopic correction. That is simply a matter of trial. Not infrequently, though, I find that I make a difference of a quarter of a diopter with satisfactory results.

One extraordinary case of difference of accommodation in the two eyes was that of the man of thirty-one referred to

in my paper. The accommodation was subnormal in both eyes, but was between one and two diopters more so in one than in the other. In one eye the accommodation was not only weaker than in the other, but was ill sustained. In fact, it would fall one or two diopters during examination. He wore an unequal presbyopic correction with only moderate satisfaction, but that seemed to be the only thing that helped him for the time being. The cause of this condition was unknown, but he had both dental infection and intestinal toxemia, which were in a way to be remedied when I saw him last.

Regarding what Dr. Howe said about the use of minimal doses of atropin and eserin in testing accommodation, I would say that I have had no experience with this. I have made a great many examinations under our usual doses of these drugs to test the effect on accommodation. Under homatropin I have a collection of considerably over 1000 cases that I hope to present the results of. Some of these are extremely surprising, as running counter to the ordinary theories of accommodation presented by Hess (in Graefes-Saemisch) and others.

NERVOUS SYMPTOMS FROM CONTUSIONS OF THE EYE.

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The nervous symptoms, including shock, which complicate contusions of the eye, exhibit many interesting variations. My conclusions are based on ten years' observations of 40 cases treated, a few as private patients, the remainder, with few exceptions, cared for at the Boston City Hospital. Since my first report* in 1911 of this kind of ocular injury there has been abundant opportunity to study other interesting cases. As the number of injuries of this character in-

* *Boston Med. and Surg. Journal*, November 9, 1911.