If I saw a case of sympathetic ophthalmia I would not remove the first eye if it had useful vision. On the other hand, if the injured eye has no vision, or it is very low, it is wise to enucleate at once, since statistics plainly show that enucleation increases the chance of vision, even when it is done late.

THE VALUE OF CYCLOPLEGIA IN OPTOMETRIC EXAMINATION.*

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This paper is, at least in part, deduced from a review of the records of examination of 1000 eyes of my own patients, in private practice, in which artificial cycloplegia has been purposely produced for the sake of optometric examination. The case records of 5257 of my first private patients have been required in order to have the desired data concerning 1000 eyes. Of the cases in which cycloplegia had been produced for the purpose of optometric examination, 19.7 per cent. were unfit for use in the preparation of this paper, because of the incompleteness of my novitiate records, which incompleteness prevented the desired comparison of the seeming static refraction, before cycloplegia, and that found during cycloplegia. The number of eyes, the records of whose examination are trustworthy—1000—was chosen partly because of the facility of computing percentages from that number and partly because time for reviewing a greater number was not found. The usual effect of cycloplegia, showing itself as an increase in the discoverable amount of hyperopia or decrease in the strength of a concave lens necessary to enable the myopic eye to see well, has, in this paper, been called a gain. In some cases the opposite effects were obtained; that is, the hyperopia has appeared less or the myopia more, during cycloplegia, than before it was produced; such eyes have been accounted as furnishing a "loss." Of the 1000 eyes, 89.9 per cent. furnish gain, 4.5 per cent. furnish loss and 5.6 per cent. neither gain nor loss. These percentages may have been affected by the fact that the examiner is apt to use a deal of effort and patience to bring the manifest hyperopia as nearly as possible to the total before having recourse to artificial cycloplegia. A gain of any amount of corrigible astigmatism has been estimated at half that amount, numerically, since a unit of gain, at right angles to the cylinder-axis, seemed to need to be averaged with the zero in the direction of the axis; which average seemed fairly stated as one-half the sum of the two. The rays entering an eye are proportionately more refracted as they are farther from the line of vision. This is partially or wholly explanatory of the 4.5 per cent. of cases in which cycloplegia resulted in what has here been called loss. It has been sought to eliminate the influence of existing fundus inflammation, in the cases reviewed, since the effect of no cycloplegic drug can neutralize the effect of such inflammation. Acting on the instruction of Dr. Edward Jackson and the corroborative testimony of Dr. Florence Mayo's investigations, it was assumed by me, years ago, that the instillation of a 2.5 per cent. solution of the hydrobromate of homatropin, in an eye, six times, at intervals of five minutes, will produce cycloplegia within an hour from the time of the first instillation. Such cycloplegia has not always resulted. In a few cases the instillation of the cycloplegic solution needed to be continued. In 14 cases of the 1000 eyes under consideration, the eye whose cycloplegia had been so sought could read Jæger's No. 2, at 24 cm., an hour after the time of the first instillation. In some of such cases the incompleteness of the cycloplegia may, perhaps, be explained by the carelessness of the person who made the instillations, although the attendants who have been entrusted with the use of the cycloplegic have usually been carefully taught, by the examiner or some experienced attendant, in the method of its use.

The total gain in the 1000 eyes was 640, 732 diopters; the total loss was 13,875 diopters; total, 626,857 diopters. Hence, average gain was .6268 diopter. There were 799 of the eyes which furnished gain, 44 loss, and 157 neither gain nor loss; 299 eyes furnished a gain of .5 D. or less; 218 gain of more than .5 D., but less than 1 D.; 96 a gain of more than 1, but less than 1.5 D.; 45 a gain of more than 1.5 D., but less than 2 D., and 17 a gain of more than 2 D., but less than 2.5 D.; 14 furnished a gain of more than 2.5 D., but less than 3 D.; 7 a gain of more than 3 D., but less than 3.5 D., and 2 a gain of more than 3.5 D., but less than 4 D. None of the eyes furnished a gain between 4 and 5 D.

One eye furnished a gain of 5.5 D. It was the *right* eye of a girl with slight convergent strabismus, whose *left* eye furnished a gain of 3.5 D. She was 11 years old when examined, in 1894; the use of Dr. Casey A. Wood's ophthalmic discs, No. 342, one hour, raised the hyperopia of the right eye from 2.5 to 8 D., that of the left from 2.5 to 6 D.; each eye was astigmatic, the right by .75, the left by 2.25 D.; this amount of astigmatism was common to each eye before and during the cycloplegia. It seems worthy of note that, in each of these eyes, the obtainable acuteness of vision was greater during than before cycloplegia; that of the right was increased from less than 6/9 to 6/6 of Snellen's standard, and that of the left from less than 6/21 to 6/12 of Snellen's standard, by the cycloplegia, or, at least, during it.

Forty eyes furnished a loss of .5 D., or less; 2 a loss of more than .5, but less than 1 D.; 2 a loss of more than 1, but less than 1.5 D., and none of the eyes furnished a loss greater than 1.5 D. None were those of persons less than 5 years old; 31 eyes of persons from 5 to 10 years old gave an average gain of 1.05 D.; 92 eyes of persons from 10 to 15 years old gave an average gain of 0.75 D.; 225, of persons from 15 to 20 years old, gave an average gain of 0.56 D.; 228, of persons from 20 to 25 years old, gave an average gain of 1.219 D.; 160, of persons from 25 to 30, gave an average gain of 0.58 D.; 128, of persons from 30 to 35, gave an average gain of 0.664 D.; 101, of persons from 35 to 40, gave an average gain of 1.05 D.; 25, of persons from 40 to 45, an average gain of 0.54 D.; 7 were those of persons between 45 and 50 years old, and gave an average gain of 0.446 D.; 3 were those of persons between 50 and 55, and gave an average gain of 0.125 D.

In a few cases I have found more hyperopia evident some time after cycloplegia than before or during it. Case 5231, a woman, 23 years old, had 100 per cent. of visual acuity, according to Jackson's standard, with each eye, without a glass or with convex, spheric .75 D., the ciliary muscle being normally contractile, on Sept. 10, 1895. On October 2, 2.5 per cent. solution of hydrobromate of homatropin was instilled in each eye, as described above. Seventy-three minutes after the first instillation, each eye had the same visual acuity—100 per cent. Jackson—with each convex, spheric 1.25. On May 26, 1899, each eye had the same visual acuity as on the former dates just given, with each convex,

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spheric 1.75. How this is to be explained, since no disease was found in either eye at any of the examinations, is a question I ask—not answer. Another similar experience is somewhere recorded in my case records, but the time to seek its history has not been found.

Experience with the 1000 eyes in question has helped lead to the conclusions:

1. A solution of 2.5 per cent. of homatropin hydrobromate, instilled six times, at intervals of five minutes, provides trustworthy cycloplegia in the average, healthy human eye, in from one to three hours from the time of the first instillation; usually in an hour or ninety minutes.

2. As a rule the protracted use of a 1 per cent. solution of the sulphate of atropin is no more effective, as a cycloplegic, than is the 1:40 solution of the alkaloid above mentioned.

3. In 10 per cent. of patients consulting an ophthalmic surgeon, it is desirable to produce artificial cycloplegia. In such cases the production of cycloplegia is inevitable, if the examiner will provide refractive correctives that shall afford the patient the *best* service.

DISCUSSION.

DR. EDWARD JACKSON, Denver, Colo.—My experience with homatropia is that it is as reliable as any other mydriatic. I have used it for fifteen years, chiefly for private practice; and the other mydriatics in hospital work. So I have been able to compare the results obtained, and testimony of that sort is worth more than single failures of the drug to produce mydriasis. There is no mydriatic that has not failed me at times, but it has happened just as rarely with homatropia as with any other. With reference to cyclopegics, the idea that they are chiefly valuable in revealing hypermetropia is a mistake. The assistance they give in measuring the astigmatism and in showing the exact amount of anisometropia is their greatest value. Any of you will find, if you study your cases of hypermetropia carefully, that the amount which is latent is not constant in any case. It is not constant for a week, perhaps not even an hour, and if you are testing the two eyes without a mydriatic, you may get all the hypermetropia manifest in one eye and fail to get it manifest in the other, so that you are constantly liable to make a mistake between the two eyes. In the cases I have seen, where the correction has been made without a mydriatic, and I have afterward reviewed it with a mydriatic, the greatest fault often has been in the inequality of the amount of hyperopia left uncorrected; I am sure a low anisometropia of that sort gives quite as much trouble as a low anisometropia that has always existed.

DR. E. J. BERNSTEIN, Baltimore, Md.—I have been using homatropin for six years, and just this year I have had a number of instances of poisoning, or rather of constitutional effects. I have used only a 1 per cent. solution of Merck's salt, and use a drop in each eye every ten minutes until full mydriasis occurs.

DR. CASSIUS D. WESTCOTT, Chicago—One of the chief advantages of atropin over homatropin is in the fact that when we use atropin we make repeated examinations on different days. I quite endorse all that Dr. Jackson has said and especially that it is not so important to bring out all the hypermetropia as it is to estimate the astigmatism accurately, and to find out the difference between the two eyes. I too have observed the constitutional symptoms from homatropin more during the past year than ever before.

DR. W. T. BACON, Hartford, Conn.—I can not see why Dr. Bernstein should have toxic symptoms with his homatropin if he uses it correctly, and by that I mean allowing the drop to flow slowly over the cornea, instead of putting it in the lower cul-de-sac, and directing the patient to hold the finger over the lacrimal sac. I have had constitutional symptoms but once in the last twelve months. I think the Doctor has struck a lot of cases that probably had an idiosyncrasy against mydriatics. I have had a case where 1 drop of duboisin produced fainting inside of a minute and a half after it was used, and the patient was a powerful young man. I was not sure it was the duboisin at first, and tried it the second time, but I have no desire to try it a third.

DR. H. MOULTON, Fort Smith, Ark.—I wish to call attention to scopolamin, which is a most valuable compromise between atropin and homatropin, and I believe it is a reliable remedy. I have been using it in the strength of 1/10 of 1 per cent., repeated every ten minutes. At the end of an hour the examination may be made. I have found that in cases in which I had used homatropin thoroughly I was able to bring out a still higher degree of refractive error by the use of scopolamin.

DR. W. L. PYLE, Philadelphia—Cases of poisoning from homatropin are certainly rare, and I have never seen a case except in a series that occurred to me, and in that instance I found I was not using the pure drug. I would suggest that likely such was the trouble in Dr. Bernstein's cases, as I understood him to say that they all occurred in one series.

DR. GEO. F. KEIPER, Lafayette, Ind.—In regard to the use of scopolamin, the chemists have decided that that drug is nothing more than an impure atropin.

DR. B. A. RANDALL, Philadelphia—There is one point in regard to the use of mydriatics that has not been brought out, though urged by some of us for many years, and that is the superior value of hyoscyamin for many cases. It obtains its full power in less time than atropin, and retains it some seventy hours after the last instillation, with a thoroughness and completeness that is not equalled, and then has only some fifty hours of the trying stage of returning accommodation.

DR. H. M. STARKEY, Chicago—It has been a great pleasure to me to hear Dr. Culver's paper. There has been so much pernicious writing by certain ones in high authority, against the necessity of the use of cycloplegia in these examinations, that it is a distinct advantage to have a clear exposition of some reasons why those writings are pernicious. Each passing year with me but increases my distrust of optometric examinations made without cycloplegia. Twenty years ago, cycloplegia did not seem one-half the importance it does to-day.

I am also glad to hear of Dr Moulton's experience with scopolamin, since a drug that will produce certain results with a minimum of inconvenience to patient and physician, should be welcome. Scopolamin has been in daily use in my practice, both private and dispensary, for more than four years. For optometric examinations, it is employed half a dozen times where all other cycloplegics are used once, and because it is reputed to have less tendency than atropin to induce glaucoma, it is chosen in many cases of iritis in elderly people, and when for any cause there is fear of increasing the tension of the eyeball. In the many hundreds of cases, in which my associate, Dr. Mann, and myself have used this drug, we have seen no serious nor even annoying symptoms produced. There is rarely a little flushing following its application, but that is the extent of the unpleasant action observed. The advantages in its use, that have appealed to us, are its safety, its certainty, its convenience and its cheapness.

As to safety, after using scopolamin for so long a time and in so many cases, we feel as safe in its use as we can in any remedy whatever. While at least one case has been reported where its exhibition was quickly followed by an attack of glaucoma, we have not in any case noted any tendency on its part to cause increased tension. It is not conceivable, however, that any drug which dilates the pupil can be entirely free from such tendency. As several observers have reported unpleasant and even alarming symptoms after using scopolamin for cycloplegia, it may be of interest to note just how it is used by us. The strength of the solution employed is 1 grain to the ounce—1/5 of 1 per cent. solution—this being sufficiently strong for all purposes. We experimented with weaker solutions, but did not find the results uniform. This solution should be reasonably fresh, as it seems to deteriorate when exposed frequently to the air. We get an ounce of the solution at a time, which lasts several weeks, but we take from this bottle, into another smaller bottle, sufficient for a few days, and the larger bottle is opened but once in three or four days. The dropper used has a small tip so that it gives off a minute drop. One of these small drops is instilled into each eye, the punctum being everted for a few seconds to promote absorption and to prevent washing into the nose with the tears. While still standing before the patient, another drop is usually instilled into each eye,

when the patient is allowed to go at his pleasure, returning any time after one hour.

As to certainty, we have come to regard scopolamin, used in this way, as producing as certain and complete cycloplegia in one hour as will atropin used two days. We have had a few cases where cycloplegia was incomplete when using weaker solutions, and a few also when the solution was old, on two occasions, several occurring about the same time from such solutions. But with a fresh solution of 1/5 of 1 per cent. strength, I do not think we have had more than three or four failures in all these years, and in those further use of the drug completed the cycloplegia. It is well known that in certain cases atropin must be continued longer than two days to completely paralyze the accommodation. It is much more certain than homatropia which, while usually reliable, will fail to produce complete relaxation in from 2 to 4 per cent. of all cases.

As to convenience, nothing could be more simple for the ophthalmologist than this single instillation, and it is also a great convenience to be able to make a preliminary examination and then one hour later to complete the examination with full paralysis of accommodation. To the patient also the assurance that the eyes can be used again in two or three days, instead of being at rest for a week or two, as with atropin, is frequently a determining factor in allowing cycloplegia to be induced. The effect of scopolamin will always have passed by the third day, frequently by the second, and rarely on the next day the patient can read again.

The cost of cycloplegia with scopolamin is insignificant, one grain costing about 35 cents, and being sufficient for two or three hundred patients.

DR. A. R. BAKER, Cleveland, Ohio—Since our worthy Chairman first introduced the use of ophthalmic discs, I have had no trouble with poisoning or unreliable drugs, and we are very much indebted to him for this addition to our armamentarium.

DR. C. M. CULVER, Albany, N. Y.—I have not had any toxic effects from homatropin. That may be partly due to the fact that I follow Dr. Risley's suggestion, made five years ago, that any person using a cycloplegic should press the finger on the canaliculi to prevent or to lessen general absorption. I do not see why we need a compromise. If homatropin will do the work, and the patient can return to his duties within forty-eight hours, there is no necessity for a compromise.

CONTRIBUTIONS OF THE MEDICAL PROFESSION TO GENERAL LITERATURE AND COLLATERAL SCIENCES.*

BY GEORGE R. HIGHSMITH, M.D.
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(Concluded from p. 280.)

Coming down to this day and generation, we have marked wealth of material.

Oliver Wendell Holmes was beyond a doubt the foremost contributor to literature and science from the ranks of the medical profession, during the past fifty years. He combined high scientific attainment with the greatest versatility and the rarest literary genius. He was equally at home among the dry bones of anatomy, within the glow of the crucible, or amid the revelations of the microscope; as a biographer, romancer, novelist, philosopher and poet, he takes high rank. Dr. Holmes' works are known and read of all men, consequently further reference is unnecessary.

Thomas Henry Huxley, 1825-1895, graduated from the medical school at Charing Cross Hospital in 1845, was appointed assistant-surgeon on H. M. ship *Victory;* then assistant-surgeon on the ship *Rattlesnake.* In 1851 he was elected a Fellow of the Royal Society. In 1860 he began his lectures on the "Relation of Man to the Lower Animals," in which he adopted Darwin's theory of evolution. He is too well known to require an extended notice.

Sir John Kirk, born in 1833, received his degree of M.D. from the University of Edinburgh, served on the civil medical staff during the Crimean War, and was medical officer and naturalist for the second expedition of Dr. Livingstone. Dr. Kirk wrote a "Report of Geological Discoveries in East Africa," and was knighted in 1881.

Samuel Kneeland, born in 1821, practiced until the beginning of the Civil War, then served as surgeon in the U. S. Army until 1865. In 1866 he was made professor of zoölogy in the Massachusetts Institute of Technology. Dr. Kneeland wrote "An American in Iceland," and "Wonders of the Yosemite."

Joseph Leconte, born in 1823, graduated from the College of Physicians, in New York, in 1845. He practiced medicine in Macon, Ga., until 1850, when he went to Cambridge and studied under Agassiz. Since 1859 he has been professor of natural history in the University of California. His works are "Mutual Relations of Science and Religion," "Sight," "Elements of Geology," "The Agency of the Gulf Stream in the Formation of the Peninsula of Florida," "The Correlation of Vital with Chemical and Physical Forces," "The Great Lava Floods of the Northwest," "Structure and Age of the Cascade Mountains," etc.

Joseph Leidy, 1823-1891, graduated at the University of Pennsylvania in 1844. He practiced medicine and taught anatomy, serving through the Civil War as an army surgeon. In 1871 he became professor of natural history in Swartmouth College. Dr. Leidy wrote more than a hundred papers on biology and kindred subjects.

Henry Morley, 1822-1894, graduated at King's College, London. In 1844, he located at Madley, Shropshire, where he practiced until 1848. He is the author of two volumes of "Fairy Tales," and "English Writers before Chaucer," etc.

John S. Newberry, 1822-1892, graduated at Cleveland (Ohio) Medical College, in 1848. He practiced medicine in Cleveland until 1855, when he was appointed assistant-surgeon to the U. S. Survey of Northern California. During the Civil War he was connected with the U. S. Sanitary Commission. After the war he became professor of geology in Columbia College, New York City. In 1869 he was appointed state geologist of Ohio. He contributed many papers on natural history and geology, the most of which are to be found among government reports and reports of New Jersey and Ohio.

Robert G. Latham, 1812-1888, studied medicine and became assistant physician at Middlesex Hospital. He lectured on forensic medicine and materia medica. His works are "Norway and Norwegians," "Varieties of Man," "The English Language," "Nationalities of Europe," "A New Edition of Johnson's Dictionary," and "Russian and Turk from a Geographical, Ethnological and Historic Point of View."

Herman August Hagen, 1817-1893, graduated in medicine in Koenigsberg, and practiced medicine for several years in his native land. In 1867 he came to Cambridge as assistant to Professor Agassiz. In 1870 he was made professor of entomology at Harvard. He is the author of several works on entomology.

Herman Helmholtz, 1821-1894, graduated in medicine at Berlin and was attached to one of the hospitals. He afterward served as surgeon in the German army. Among his works are "Preservation of Force," "Theory of Impression of Sound," "Sensation of Tone as a Physiological Basis for the Theory of Music" and "Popular Lectures on Scientific Subjects."

Sir Joseph Dalton Hooker, 1817-1892, was assistant-