

# Cataract

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**The author describes an optical method that improves vision and has a therapeutic effect**

It is not the purpose of this paper to treat with all varieties of cataract, but to deal with senile or simple cataract, which is the most common type met with in everyday practice, and to mention briefly a few other varieties where the occasion warrants.

Senile cataract usually begins at the age of 50, and in some cases as early as 40, at, or some time after the onset of presbyopia. One of the earliest symptoms noticeable is the gradual development of myopia, transforming a hyperope into a hyperope of lesser degree or into a confirmed myope, and neutralising part or all of the presbyopia. This state is known as senopia or second sight brought about by an increase of the index of refraction of the layers of the crystalline lens followed by an opacity which might be nuclear or cortical. Some senopic cases never reach the stage of an opacity; others mature into complete cataract in two to three years or longer. Very seldom does one clear up spontaneously.

It has been proved that certain of the known invisible rays of the spectrum play an important part in the formation of cataract. The infra-red rays, of the long wave-length end of the spectrum, that reach the eye are those that come from white-hot and red-hot bodies, but none from bodies of less heat. These rays must be taken into consideration when we search for a cause of the cataract so prevalent among glassblowers and other workers before furnaces of great heat. Because, after being thrown out by the incandescence of a furnace or crucible, the heat rays, according to Vogt, reach the eye in greater numbers than any other rays, are densest in the posterior part of the lens and are there absorbed more than by any other medium. Sheard suggests that the absorption of heat by the pigmentary layers of the iris, which acts as a conductor on to the glandular elements of the ciliary body, brings about an abnormal secretion of the aqueous and in turn causes a malnutrition of the lens developing into cataract. Artificial lights contain more of these rays than are found in natural light and we may regard most artificial lights as a dangerous source of these emanations.

It is interesting to note that it was by these same rays the old Arab priests blinded themselves after a visit to the tomb of Mahomet, so that their vision would not be polluted by any other earthly object after the sight of so sacred an edifice. To accomplish this bricks were heated and then applied close to the eyes until sight became extinct.

So much importance was placed on the ill effect of these rays that when Sir William Crookes was experimenting on the glass which now bears his name he had in mind certain recommendations of the Glassblowers' Committee of the Royal Society and succeeded in absorbing the infra-red rays in perfecting his special glass.

The ultra-violet rays or rays of the short wave-length end of the spectrum, says Dr. Goetz, do not penetrate as deep as the infra-red, doing more damage to the outer structure of the eye; but it has been found that some of the longer violet and ultra-violet do reach as far as the lens where they are largely absorbed causing dim vision by their fluorescent action; further, light well absorbed becomes heat which, applied in sufficient concentration, has a destructive effect.

The crystalline lens is albuminous in substance, and Hansen and Dreyer have proved the coagulating effect of ultra-violet rays on albumen. Chalupecky and Schanz have demonstrated that these rays affect the lens so that easy soluble matter becomes less soluble in such a way that when pigs' eyes were exposed for three hours under the quartz lamp they developed 13½ per cent. less soluble matter. We will find a similar condition in the eyes of a presbyope and it is probable that these rays caused the hardening and opaqueness of the lens in old age, and in the words of Dr. Schanz "we must regard these rays as the cause of presbyopia and cataract."

There can be no doubt that infra-red rays do cause cataract as evidenced by the experiments of Hartridge and Hill who took their cue from the prevalence of this disease among glassblowers. It has further been proved that heat rays take a long period of time to produce marked effect in the lens as compared with



ultra-violet rays under certain favourable conditions.

By the experiment of Burge, if we expose the white of an egg placed on a glass slide to ultra-violet radiation no visible change takes place, but if we immerse it in a 0.1 per cent. solution of calcium chloride after the exposure the white will become opaque.

There are further experiments with fishes and frogs which show that when these animals are placed in water having a 0.1 per cent. solution of sodium silicate and exposed to the short wave radiations one finds a marked development of cataract in a matter of hours resembling that found in the human eye, but the same experiment undertaken with tap water over the same period of time does not produce cataract.

The above experiments first produced some opacity of the cornea, which would lend support to the belief that arcus senilis seen at an early age is symptomatic of cataract development later in life.

From what has been said we may conclude that the presence of certain salts facilitate the formation of cataract when the eye is exposed to the short wave radiation, and further evidence can be found on the analysis of lenses removed in cataract operations. The percentage of calcium, magnesium, sodium, and silicon being far in excess of that found in normal eyes.

Another conclusion can be drawn from the fact that one finds a high percentage of cataract in India where there is intense light and the presence of an excess of salts in the systems of the natives as compared with Europeans (Sheard). Sheard suggests that the ultra-violet may be the cause of the sudden onset of cataract in diabetes assisted by the altered blood condition found in this disease. This seems to be borne out by the fact that an experiment with 1 per cent. dextrose produces the same results obtained with fishes and frogs immersed in 0.1 per cent. sodium silicate. According to Deutschmann a concentration of 5 per cent. sugar alone would cause an opacity of the lens, but this amount has not been known to occur in diabetes.

Urinalysis should be made in every case of myopia in adults where there is evidence that the patient was hyperopic or emmetropic previously. A great many cases of diabetes have been brought to light in this manner. Diabetic cataract like senile cataract is usually preceded by senopia or second sight.

The writer has observed simple cataract in British Guiana, which has a large Indian population, in about 50 per cent. of his Indian

patients over the age of 35, and takes this opportunity of mentioning that the average span of life of an Indian in this colony is under 40 years; that he matures very early in life, and that a man of 40 to 45 has a physical appearance of an old man of about 60, that on the whole he has the physique of the small under-nourished type, which possibly has some bearing on the incidence of cataract among his race. The same applies to the women, who marry very young, bring forth children at an early age and attain the menopause at 35, a great many at 30.

The presence of an excess of salts as stated by Sheard might be due mainly to their diet which is the same all the year round and not by any means as mixed a diet as the European's. The Indian's diet consists mainly of rice which is distinctly lacking in Vitamin A and B, through his own peculiar mode of preparation; he is also an agriculturist and is exposed daily to intense light in the open field. Dr. Brown, Government ophthalmologist, states in the 'British Guiana Medical Journal' for 1932, that of his total cataract operations per annum 70 per cent. are on East Indians. This is a very high incidence when it is considered that they comprise 40 per cent. of our population.

A diet lacking in Vitamin A induces lamellar cataract in young offspring of rats. The cataract clears up when this food is replaced by the normal diet. Animals develop this type of cataract after exposure to short wave infrared rays extending over a period of one to three years.

Undoubtedly ametropia also plays an important rôle in the production of cataract, especially presbyopia, hyperopia and astigmatism. Some investigators like Javal, Martin and Vacher claim astigmatic accommodation or sectional accommodation in the crystalline lens as a cause for cataract whereby nutrition is interfered with. Whether or not astigmatic or hyperopic accommodation is one of the causes of cataract does not alter the fact that all cases of simple cataract in the experience of the writer have or had some degree of presbyopia, hyperopia or astigmatism which was never corrected or improperly corrected; and to quote Edward J. Perkins, Instructor in Anatomy and Pathology, De Keyser Institute of Optometry, U.S.A., "I have yet to find a cataractous eye which is not ametropic even in the first stage and in the ametropia you will always find astigmatism."

Those cases showing some degree of myopia (second sight) were proved to have been hyperopic originally as revealed by the history of the patient and by the nature of his old



correction. The writer can report two cases out of several in support of the theory of neglect of ametropia as a cause of cataract. One of two sisters, age 66. Visual acuity with Right Eye +1.00 D. sph. Left Eye +1.50 D. sph. 20/20. Media clear. Old glasses R.E. +0.75 D. sph. L.E. +1.00 D. sph. The other patient, age 64. Visual acuity with R.E. +0.50 D. sph.  $\ominus$  +1.50 D. cyl. Axis 180°. L.E. +1.50 D. cyl. Axis 180° 20/40? Incipient cataract both eyes. Old glasses O.U. +1.00 D. sph.  $\ominus$  +0.50 D. cyl. Axis 180°. The first patient explained that she had had her eyes examined every two to three years for the last 15 years. The other with cataract had not had a change of correction for 9 years.

Ametropia as a cause of cataract is not difficult to understand if we adopt Tscherning's theory of accommodation. An excessive contraction of the cortical layers of the crystalline, causing the peculiar reflex seen by retinoscopy, simulating (or possibly is) incipient cataract in the very early stage, has been observed by the writer in a great many cases of facultative hyperopia and which has disappeared upon treatment by repression lenses.

A very good idea of the pressure brought to bear on the periphery of the crystalline lens is well illustrated in Emsley & Swaine's 'Ophthalmic Lenses,' Fig. 71, which pictures the strain imposed on a spectacle lens when the rim is too tight.

Whatever are the true direct causes or contributing factors in the causation of cataract, aqueous infiltration seems to be the *sine qua non* of the production of this disease established by the fact that traumatism or surgery or lightning stroke or severe electric shock admits aqueous into the lens substance with the inevitable result of opaqueness.

It is not unreasonable to suggest that aqueous infiltration can be brought about by a hypersecretion of the nutritive juices of an excited ciliary body, which condition exists in eyes exposed to injurious radiation and uncorrected ametropia; and it has been shown that when there is an excess of calcium, magnesium, sodium, silicon or dextrose coagulation is considerably hastened. This might explain why on needling a healthy juvenile absorption of the lens takes place, or in other words a dissolving of the capsular contents influenced by the aqueous; but an adult lens being in a more degenerative condition and impregnated with an excess of waste matter becomes opaque after discission.

We cannot lay too much stress on the necessity of giving all available treatment to a case of cataract when diagnosed as such and not

simply to fall into a rut by telling the patient that nothing can be done until the cataract is ripe for operation.

The writer early in his practice besides advising, examination, and treatment of any systematic derangement by patient's family physician, advised as much abstention from close work as is possible under the circumstances, advocated strongly the correction of any refractive error both for far and near, distance glasses to be worn constantly incorporating in the prescription a suitable tint that would absorb the ultra-violet as well as the infra-red rays without appreciable reduction in visibility.

Crookes' A glass came up as near as possible to this standard, absorbing nearly all the ultra-violet, about 40 per cent. infra-red and 1 per cent. visible rays. In cases of moderately low visual acuity I found it far more expedient to prescribe a medium colour that approaches as close as possible these standards and at the same time increases visibility by transforming the invisible short rays into longer visible rays as claimed for Amber, Noviol and other allied colours; but when the opacity was relatively large it was advisable to prescribe darker colours which brought about a dilation of the pupil exposing the unaffected area of the lens.

Crookes, Amber, Fieuzal and Noviol were extensively prescribed in various depths of colour on these cases for a number of years. Whilst improving vision to a great extent in many cases these lenses had no effect in retarding the progress of the cataract.

It was not until I had tried a lens possessing some absorbent qualities coupled with a peculiar effect on cataract that I awoke to the great possibilities of treating this complaint by optical means. Of several cases fitted I have had opportunity of keeping only six under observation, three cleared up and three remained stationary.

The first patient so fitted was a schoolmaster of 58 years of age suffering from what appeared to be progressive myopia. Not until his myopia reached 7 D. did the writer notice nuclear opacities in both eyes; and having in stock a pair of these lenses ground in this particular tint, they were prescribed and nothing was told the patient of his having cataract. This man was seen four years after and there was no sign of an opacity. He was so pleased with the improvement in vision that he would not submit to a slight change in correction nor even a duplicate pair for fear of not obtaining the same kind of glass.

These lenses were first prescribed for cataract on the recommendation of the late



Dr. Frank Johnson, Astoria, Ore., U.S.A., who spoke highly of the result of same from their use, ably supported by many other American practitioners including E. W. Wheeler, Withers Bagwell and Edward J. Perkins. These men claimed that medium cobalt blue cleared up the opacities in the majority of cases of cataract both in the incipient and the advanced stages.

But, we are told that cobalt blue is transparent to ultra-violet and infra-red but impervious to visible light. How are we to explain this apparent paradox when we have already stated that ultra-violet and infra-red are causative factors in producing cataract and should be excluded? The answer is in the wave-lengths of these particular rays. This special lens absorbs the harmful wave-lengths and changes them into wave-lengths that seem to be capable of decomposing a cataract and restoring normal metabolism between eye and lens.

Waves of very high frequency definitely have some therapeutic value in cataract treatment as shown by Dr. Briggs, who used the quartz ray lamp, but systemically, not on the eye itself. The wave-lengths employed in his treatment were those found between the ultra-violet and x-rays.

There are several other claims made for cobalt blue and to quote E. E. Shriener—in 1854 Robert Hunt of England magnetised a piece of steel for a compass needle by passing the sun's rays through a piece of cobalt glass and then through a convex lens.

In 1871 General Pleasanton of Philadelphia demonstrated that both animal and vegetable life could be stimulated by sunlight filtered through dark cobalt blue glass. By the aid of blue violet glass smokeless powder can be detected. In Germany there was a custom of cauterising sores by sunlight after having passed through a cobalt blue convex lens.

We all know that the visual acuity in an incipient as well as an advanced state of cataract can be improved by the pinhole depending upon the situation of the opacity. Within recent times several forms of lenses have been manufactured simulating the pinhole and which have given marvellous results in so far as an improvement in vision is concerned. The writer remembers reading an article some years ago by Ryer and Hotaling of New York who described fitting a case of cataract with low visual acuity with an Amber lens of similar construction and reported most gratifying results.

I have succeeded in making a light filter which combines improved vision with a thera-

peutic effect on cataract known as an anti-cataract lens.

Of course, one will realise that absolutely reliable statistics cannot be obtained from so few as six cases mentioned in this paper, and further, that one lot might have cleared up spontaneously without treatment and the other lot might have been in the same condition had nothing been prescribed. Anyhow, from what we know of the effects of the invisible rays and refractive errors on the crystalline lens backed by the actual experience of the writer, makes it justifiable that we prescribe anti-cataract lenses ground to patient's prescription in all cases suffering from cataract in an attempt to arrest or even absorb a cataract during the waiting period for a fit state for operation.

The writer once observed a patient, female, age 36, who had posterior polar cataract in both eyes (Stellar variety). This case was put under a three months' course of iodide treatment and light cobalt blue were prescribed with +1.00 D. sph.  $\ominus$  +0.25 D. cyl. ax 90° on R.E. and +0.75 D. sph.  $\ominus$  +0.25 D. cyl. on L.E., which gave 20/30 vision. After the expiration of the treatment there was a considerable reduction in the opacity.

The writer does not claim that the success in this case was due to the glasses prescribed, as it is generally recognised that such cases are mainly due to constitutional derangement, but simply makes mention of it to show how much can be accomplished through co-operation with patient's medical adviser.

When cataract is fully matured we can do nothing but recommend an operation by an ophthalmic surgeon. Operation without iridectomy seems to be the best form from a cosmetic point of view as this obviates squinting. Patients do squint despite the fact that the coloboma is under the upper lid. Unfortunately operation without iridectomy is not possible in all cases, and on account of the absence of the crystalline lens the ultra-violet enters the eye freely and should be absorbed by light protective tints, Crookes' A preferably.

Another point worthy of mention in aphakic cases is that they are usually more comfortable with a distant correction of +1 to +2 diopters weaker than that found in the examination room exclusive of deductions for any change in the curve of the lenses prescribed. Also a +2 to +3 D. addition for near is far better than +3 to +4 D., as is evident from everyday requirements. Again, some aphakic cases seem to have the use of accommodation, probably brought about by the action of the extrin-



sis muscles on the globe coupled with a pupillary contraction which modifies the circles of diffusion on the retina. The writer once observed a patient, cataract extracted both eyes, who read newsprint at 16 inches with his distance glasses without altering the position of spectacles on his nose. Sheard makes mention of three similar cases.

There seems to be some sort of relationship between cataract and glaucoma when we review some of the causes or predisposing factors of these two diseases.

Most cataract and glaucoma cases have hyperopia, astigmatism or presbyopia or all three, which would explain why the ciliary process and lens play such an important rôle in the formation of these dread complaints.

Obstruction to the escape of intraocular fluid at the angle of filtration and the passage of nutritive lymph in this area are brought about by a congested and enlarged ciliary process and small eyeball found in hyperopia, and by an increased lens size in presbyopia. Such are some of the causes of glaucoma. Now these same morbid conditions from the same causes—hyperopia, astigmatism, presbyopia—bring about impaired nutrition of the lens culminating in cataract.

Traumatism, which brings about aqueous infiltration and a swelling of the lens ending in cataract, usually causes glaucoma by the same swelling of the lens which promotes increased intraocular tension.

Cataract is one of the secondary diseases which is the outcome of glaucoma, and glaucoma with the exception of iritis, is one of the chief after affections of cataract. The disturbed ocular condition accompanying one usually leads to the other, and glaucoma is not an unusual sequel to cataract extraction, needling or dissection.

Very seldom does a true myope develop cataract and a myope is particularly immune from glaucoma.

It will not be amiss to mention that the peculiar reflex seen in glaucoma can and is often mistaken for cataract, with very serious consequences.

With the exception of specific infections like syphilis, cataract and glaucoma form the majority of ocular diseases that attack the human frame after middle age, and on investigation, one will always find a history of neglected ametropia.

It is peculiar that the correction of ametropia is particularly mentioned by eminent authors when writing on the subject of non-operative treatment of cataract and glaucoma.

Glaucoma is far more frequent in the tropics

than in other climes, and this would suggest that the tropical conditions influencing cataract also have a direct bearing on glaucoma. Astigmatism against the rule is very common in glaucomatous eyes and the same can be said of cataract.

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There are interesting phases discussed in this article which will be of interest to Syntonics users.

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