Thesis

On the relation of the errors of refraction to Senile Cataract, written by
Andrew Scott. S. Ayr. M.B. Ch.B.
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During the last two years I have devoted myself chiefly to Ophthalmic Surgery, and have had a large field for research at the Clinique des Zeux, at Paris, under M. De Wecker, Landolt and Reger, and during the last year at the Royal Westminster Ophthalmic Hospital, where I have held the post of House Surgeon, and have thus been enabled to gather statistics of Ophthalmic cases and practice, so that I am induced to make a branch of Ophthalmic Surgery the subject for this memoir.

I propose to take up the subject of Cataract, and especially to draw attention to the relation between it and the changes of the respective media, both previous to the formation of cataract and after its removal; and at present, these changes have not been especially brought forward in connection with the degeneration of the lens. It appears to me to be of some importance to make this connection, however remote, should it be possible to explain, and to bring it before the notice of Ophthalmic surgeons.

The causes which predispose to the degeneration or cataract of the lens are at
Presently not clearly understood, and in most cases of Simple Cataract, no cause can be given, and no apparent changes take place previous to this degeneration, whereby the patient has any idea of the trouble, of which he is going to be the subject, if a cause can be assigned for any change or ill to which we are liable, it is then more possible to avoid the change itself, by guarding against all the circumstances which have any relation or bearing upon the cause itself, and hence it is a duty of all oculists to try to obtain some idea of the changes in the intraocular circulation which lead to the cataractous degeneration of the lens, and this result can only be obtained by the careful examination of all patients presenting themselves for our inspection, as regards, general health, hereditary tendencies, and especially as to the previous refractive history of the patient, so that no cause of intraocular disturbance may be missed, which might have an influence upon the healthy condition of the refractive media, which are so often found to have existed for some time without the attention of the patient having been drawn to it.
The actual changes which take place in the lens itself, during the formation of cataract, are still a matter of which very divided opinion exist, and it is certain that many and various changes take place giving rise to the different forms of cataract.

It is looked upon as a true sclerosis of the lens fibres, whereby the fibres become swollen and opaque, and an infiltration of water is supposed by many German authorities to be the actual cause of this cloudiness, whereas, the Hyaloid Sclerosis is also held, that it is a form of dehydration of the lens substance, and that this is the actual cause of the sclerosis.

A fatty degeneration also takes place as molecules of fat have been traced microscopically in the cataractous lens, but it is equally likely, that these fatty particles were due to an infiltration, as in many cases, the cataractous condition is due to an infiltration, rather than a true degeneration; this is proved exclusively by the cataract due to Diabetes, of which there are cases on record, in which a cataract has been well marked, which, under a Diabetic treatment, have
cleared away entirely, the cataract found in the diabetic patient therefore appears to be a true infiltration, but it has not as yet been proved that any sugar is deposited in the lens matter, which appears to be the most likely deposition to take place. There are some observers, who assert that spaces are found between the lens fibers, and that these spaces are due to the absorption of the interstitial substance, and this theory coincides with the idea that it is a form of dehydration of the lens; but these spaces are not a real constant, and in cases of soft cataract, where the lens is swollen and fluid, it is impossible to suppose that it is due to absorption of water, but appears to be due rather to an infiltration.

The coloration of cataracts vary greatly, the soft and diabetic form clear a silvery pale yellow coloration, whilst in many cases a nucleus, which is slightly tinged with yellow, or is even more white than the surrounding substance. In the white form, the coloration varies from an almost white to the rare form of black cataract, and this coloration is supposed to depend entirely upon the blood pigment.
The portion of the lens which first becomes opaque varies in many ways, and in some cases the nucleus of the lens forms a small opaque area near the peripheral, and these opaque areas appear to be of a whitish colour, when the light is focused upon them directly; whereas, if examined by the indirect method with the ophthalmoscope the nucleus and these appear dark in the red illumination of the fundus.

But in many cases the centre of the lens appears transparent and quite free from any cloudiness or opacity, and fine streaks are observed, stretching towards the centre from the cortex. These streaks appear to have their origin from the capsule of the lens, appear to spread in a central direction from the cortex.

If the capsule of the lens has been exposed in any way, the part of the lens nearest to the hyaloid capsule becomes cataractous and the degeneration spreads equally through the lens substance, until it is all opaque; but in some cases, a small portion becomes cataractous, and the degeneration becomes limited, the rest of the lens remaining transparent and healthy.
The time which a cataract takes to arrive at a natural, varies through wide limits, in some cases being only a few months 3 or 6, or in others extending over a period of three years.

Soft cataract is a much more rapid process, as a lens swells up and becomes fluid and milky in a week; and in most cases of traumatic cataract, it is necessary to operate at an early date, as there is increased tension, great pain, and inflammation, due to the swelling up of the lens matter, and as a rule, the inflammatory symptoms pass off at once, as soon as the lens is removed and thus the intraocular tension diminished; in rare cases the swelling of the lens takes place to such a degree, that an iritis is caused by pressure upon the iris, and glaucomatous symptoms may also result, and therefore it is necessary to keep a careful watch upon patients suffering from traumatic cataract, in case of these results taking place, which would require an early operation for the sake of the eye; and in order to prevent the occurrence of a sympathetic inflammation of the other eye.
The respective media are all so intimately connected, in order to act in union, and thus perform the complicated mechanism of accommodation, that it is only natural to suppose that any interference with the normal function of each part of this mechanism, would act in an injurious way upon the remaining media, and so we are led to suppose that the emmetropia will be as regards accommodation, the mother of the acting mechanism, and so any deviation from emmetropia from whatever cause, would be likely to have an injurious effect upon accommodation and the normal functions of the eye.

In simple hypermetropia and myopia, these differences are as a rule remedied by means of the proper correction, and nowadays, as the correction of astigmatic errors is becoming more general, and more thoroughly understood, the refraction of patients suffering from these abnormalities, is being placed in a position as near to the normal refraction as possible. In fact, now there are numerous cases in which, the respective errors are not thoroughly corrected, and thus these people, are liable to the effects of the
irregular and unsatisfactory efforts of accommodation, and these efforts when of long duration or marked frequency are all the more likely to be injurious to the intraocular circulation, and thus intraocular changes may be produced, which are the primary cause or precipitating cause of the ophthalmia degenerativa.

Astigmatism of whatever kind, simple, mixed or compound, may be either due to the irregularity of the surface of the cornea, or due to the shape or position of the lens itself.

Corneal astigmatism may be distinguished by means of the keratoscope, and to the practical observer also by means of the shadow test or retinoscopy: by the help of the keratoscope the axes of the astigmatism is and are discerned, and it is in the axis of the circle which are reflected upon the cornea, with the axis axis most elongated, in fact, the long axis of the ellipse is the axis of the greatest amount of astigmatism: if the astigmatism is irregular, the reflected circles will be broken up and distorted, and the axes may not be more elongated in one axis than in any other.
Corneal Astigmatism may be due to the uneven curvature of the Cornea with no apparent cause, or, as in many cases, it is due to alteration of the Cornea. The precludes may be distinguished, showing the actual cause of the irregularity.

Corneal astigmatism is a frequent result of operations upon the eye. It may be considered that, after an iridectomy has been performed, corneal astigmatism is found in nine cases out of ten, but the degree varies greatly, and an amount of less than 1 Dioptr does not in many cases, give rise to much inconvenience after such an operation, and the patient often prefers the spherical correction to the combination of spherical and cylinder.

Astigmatism due to the lens, can only be diagnosed by means of the Ophthalmoscopic examination, and when it is necessary, to have the pupil fully dilated, so that all effort at accommodation is paralyzed. When the cornea does not show any astigmatic error by means of the Keratometric examination, and retinoscopy gives a marked degree of astigmatism, then it is certain that the astigmatism is due to the lens itself, and it may be accounted for
abnormal shape of the lens, or by a
dislocation or slight tilting of the lens.
Donders in speaking of astigmatism due
to the shape of the lens itself, says:
"The surfaces of the lens might be ellipsoids
with unequal axes, of which the maximum
and minimum need not coincide with
those of the cornea," and this theory is now
acknowledged to be a cause of astigmatism.
Again with regard to the oblique portion
of the lens, the degree of error is usually
very marked, as a slight obliquity gives
rise to great aberration of the focal rays.
This obliquity might be accounted for
as the result of some blow or concussion,
but this is not always the case. In there
are many cases it must be accounted as a
malposition rather than a dislocation.
In some cases the patient can improve their
vision to a marked degree by looking
through glasses at an angle, and thus
getting the help of the lens to correct
the obliquity of the lens itself, but even
when of slight degree the vision is much
impaired, and it is impossible to arrive
at any satisfactory correction by means of
the combination of spherical, cylindrical,
glasses, as in other forms of astigmatic error.
The Causess of Lensile Cataract

To account for the cataracts condition of the lens in many cases is a very difficult matter, for the surgeon, as perhaps the patient has never had any previous affection of the eyes, enjoyed good eyesight, the appearance of the struc and opacities of the lens being the first trouble which has induced him to seek the aid of the ophthalmoscopic surgeon; there may be no history of cataract previously lying in any of his family, and in fact the cause of the degeneration of the lens may be absolutely passing.

Heredity is an acknowledged cause of cataract, as in a large proportion of patients who present themselves for advice, the history of cataract in either father or mother is obtained, or even the grandparents may have been the subjects of a similar trouble; and very frequently members of the same family show a series of opaque lenses, which leaves little or no doubt as to heredity being one of the causes of senile cataract—previous inflammations, or their traces are left here often found in eyes, which have the opaque lens, such as adherent iris,
debulking of the cornea, and in posttraumatic exudation, the results of choroiditis, etc., are often found. In the cataract may be due to the disturbance caused by the intravascular circulation by the previous inflammations.

The general health is also a cause, as in Diabetes, but the cataract is 20% true senile cataract. It is of coarser form, the cortex being fluid and of a more milky appearance; the age of the patients is generally also a characteristic as the diabetic cataract shows itself at an early age, generally between the ages of 40 to 50. There has been no connection shown between any other diseases and the formation of cataract, but it is quite possible that any disturbance to the circulation might be injurious to the health, nutrition of the lens, which seems to undergo degeneration so readily, when its nutrition is even slightly interfered with.

There are also cases of traumatic cataract in old people, but these are generally to be classed as soft cataract; the lens may not be dislocated, but cataract is often the result of a blow on the head, which leaves no apparent result immediately afterwards.
and perhaps at a few months interval
the lens becomes opaque and cataractous,
which can only be accounted for by some
slight dislocation of the lens which is
apparent to the optical microscope,
examination of the eye, and which has
left no visible trace of intraocular distur-
ence, but which has in interfered with
the health, circulation and conditions of the
lens that a cataract is the result.
In many cases a detachment of the retina
is also found, and it would be as well to
warn the patient. He presents himself
with a detachment of the retina due to a
blow, that there is a chance of a cataract
also resulting from the injury.
From the researches of Mr. Vacher of
Orleans, another cause, which plays a
prominent part in the formation of
cataract, is, abnormalities of refraction,
and these abnormalities will bear a
distinct influence on the date of appear-
ance of opacity of the lens, as appears
the greater the abnormality, the earlier
the appearance of cataract, and so the
enactropic eye may be safely said to be
the least likely to suffer from cataract, and
the different variations and complications
of the refractive media, according as they
are of high degree, have an increasing
influence on the predisposition to cataract.
It seems from careful examination that
a myopic errors of refraction are less likely
to give rise to cataract than hypermetropic,
but still it is by no means uncommon to
find cataract in persons having been
myopic all their lives, and this might
be accounted for by the fact, that in
simple myopia full correction by means
of glasses is much more frequently met
with than full correction in hypermetropia.
Besides, the ciliary muscle is not so
constantly strained and overworked as
cases of hypermetropia, as the patient's
vision is practically quite efficient for
near vision and only requires correction
for distant objects.
In hypermetropic patients cataract is
more frequently met with, and alike
there are indescribable cases of hypermetropic
vision, even of high degree, who live to
great age without any appearance of
opacities of the lens, still it appears
that the hypermetropic eye is more prone
to the formation of cataract than the
myopic or emmetropic, and I would
account for the sequelae of hypermetropia by means of the more constant strain and frequency of the ciliary muscle in the active accommodation for near vision, which is rarely under full correction by means of glasses, and which therefore leaves more work to be executed by means of the accommodatory power of the muscle, and thus the intraocular circulation and tension undergoes larger variations than in the normal or even the astigmatic eye.

It would be interesting to know if those people with hypermetropia who have to follow an employed thorough life, which necessitates the constant accommodation of the eyes, such as printers, clerks, etc., are more liable to cataract than those whose vocations do not call for the same strain on the accommodatory power. But as yet there has not been any form of statistics, whereby any determination can be arrived at on this subject, and an account of the length of time that such a record must naturally extend over. A would of necessity be an arduous and somewhat unsatisfactory task. From Dr. Vacker's interesting record, and from one case, which I have been able
To examine myself, I think that Astigmatism may be definitely traced as one of the circumstances which predispose to the formation of cataract, and if this becomes an acknowledged fact, it will become one of the most active inducements to hold on to astigmatic patients to undergo the trouble of being tested under Atropine, as carefully as possible, in order to place the respective media in as favorable a position as possible for the duties that it may be called upon to perform.

To be enabled to trace the connection between Astigmatism and Cataract, it is necessary to make careful observations as regards these four points—

I. The Frequency of Astigmatism in senile cataract cases.

II. If a patient shows one eye cataractous and the other not, whether the cataractous eye is Astigmatic, if the other is not, or if Astigmatism is more marked in the cataractous eye.

III. When a patient has both eyes opaque, if the most mature cataract is found in the non-astigmatic eye.

IV. Whether cataract appears at an earlier age, in the astigmatic patients.
in definite proportion to the amount of astigmatism preceding it.

From a careful examination of 50 cases
Dr. Vacher found that 41 of the patients showed some slight degree of astigmatism, varying in amount from 0.5 D to 3 D and upwards.

In every record all cases showing traces of previous inflammation, ulcers of cornea, or any rigs which might have given rise in an independent manner to degeneration of the lens, have been left out of the list, but of the 41 cases which showed the astigmatic error in refraction,

In seven cases the error did not exceed 1 Dioptr-
In 24 cases the error ranged between one and three Dioptries,
In 10 cases the astigmatism exceeded the three dioptries.

II. In order to prove the second point, the number of cases are not numerous enough to give any grounds for a positive assertion, but out of the 50 cases, we have only 2, in which one eye was markedly cataractous and the other lens without a trace of opacity, but in both these cases, the astigmatism was
of high degree +4 D and +3 D, in the cataractous eye, whereas in the first case the other eye only showed -3 D of hypermetropia, and in the second as astigmatism was so small, so that it looks too small a basis to draw any conclusion, it still appears to be the constant rule that if one eye is cataractous it is more liable to become cataractous than the other which shows as astigmatism.

III. In sixteen cases of the 41 which showed the astigmatism, the amount of astigmatism was unequal, and in all these cases, without exception, the cataract was further advanced and more marked in relation as the astigmatism was of higher degree; in one case which showed a cataract, nature brought in advance of the cataract in the other eye +7 D of astigmatism was found in the most mature eye, whereas in the other the astigmatism did not exceed +3 D.

In some cases, where the astigmatism was unequal, there did not appear to be any difference as regards the cataracts of the two eyes, but in 20 single cases, was the most mature cataract found in the eye.
eye, which was the least astigmatic. The fourth and last point to note with regard is the bearing of astigmatism upon the formation of cataract, is with regard to the average age at which the cataract makes its appearance, the difference which the higher degrees of astigmatism apparently make in its early development, as from the 50 cases from which these observations are made it appears that the higher the degree of astigmatism the earlier the appearance of cataract, this is not so marked in the low degrees of astigmatism, but in the cases where more than 3 Dioptries of astigmatism was found, the appearance of the lens facilities seems to have been at a uniform earlier period of life. The average age of the nine patients who showed 3° of astigmatism was 67 years when the cataract was mature. In the seven cases in which the astigmatism did not exceed 1 Dioptry, the average age was 69 years. In the twenty-four cases in which the astigmatism reached 5° to 3 Dioptries the average age was 65 years.
the astigmatism was in great amount and
in no case less than 3 Dioptries. The age
was 60 years, thus showing that the
high degree of astigmatism a head-started
the formation of the cataractous degeneration.
In 5 of these cases there is a history of cataract
in Father or Mother; and of these five cases
we show a very early appearance of the
cataract itself, at the ages of 51 and 62.
In both these cases the astigmatism appears
to have been hereditary, and of
marked degree, in the first of 25 D
and in the latter it was as such as 35 D.
In three cases, the brothers or sisters of the
patients also have cataracts, but no
definite account of astigmatic vision
has been arrived at in these cases.

From these statistics it seems apparent
that there is a distinct connection between
astigmatic errors of refraction and the
frequency of cataract in old people,
and it also appears that the degree
of astigmatism has a marked effect in
the hastening the cataractous formation,
and so in future it will be of still
further importance to correct the astigma-
tism as carefully as possible, so as to
render the refraction as nearly normal as
possible.
The various modifications of Von Graefe's method of extraction of incle cataract, are so varied, and performed with such success by the oculists of the present day, that it becomes a not difficult task to bring forward any special operation as being the most generally successful. The operation and results depend entirely on the habit or preference of the surgeon, and there are always to be found many surgeons who advocate the modified linear extraction without iridectomy, and as many who advocate the practice of iridectomy, either with the cataract extraction or as a preparatory measure some weeks or months before the actual extraction is to be performed.

Since the introduction of Cocaine into Ophthalmic surgery the operation has been rendered so much more simple, and the results have been more gratifying, that many surgeons have been enabled to alter their modus operandi to a great extent, the manipulation of the eyeball, when the patient is able to obey the instructions of the surgeon, has effected many little changes, which would have been impossible with the patience under
an anaesthetic, or suffering the acute pain of the operation without any thing to relieve or dull the sensation.

There are many cases in which an iridectomy is rendered necessary, such as previous cataracts, or when the nucleus of the lens is large and will not pass into the corneal wound. It is often necessary to remove a portion of the iris from the upper segment, and in these cases it is better to perform the iridectomy than to stretch and tear the iris, which is then most likely to inflame, and thus be injurious to the successful result of the operation.

I have been enabled to gather the statistics of 101 operations for the removal of hard cataract, which have been performed during the past year at the Royal Westminster Ophthalmic Hospital, during my residence as House Surgeon, and I am thus enabled to weigh the advantages of the different operations, as well as to judge of the result as regards vision, relief from the operation, accidents during the operation.

Of the 101 operations, 52 were performed without iridectomy, and the remaining 49 an iridectomy was performed either previously.
To the operation at the same time.

Of the 52 cases operated without an iridectomy being performed.
Loss of vitreous took place in 5 cases during the operation.
Cortical substance was not perfectly removed in 10 cases, thus a
resulting was rendered necessary at later period.

Prolapse of the iris occurred in 5 cases, but this accident was not injurious or
painful for the patient. The small protruded sac of iris, being whipped off a fortnight
after the operation, and in each case the
result was perfectly satisfactory; this
accident would be much more rare if a
1/2 per cent. solution of cocaine was used at
the end of the operation, and the eyes care-
fully bandaged up immediately, not
touched or unbandaged for at least
36 to 48 hours.

As in two cases, the iris slipped back so
satisfactorily, the surgeon discharged with the
eyes closed, and then the eyes were
examined at the end of the 5th or 6th day.

A prolapse of the iris was found.
In two other cases the patient unfortunately
pulled the bandage, during the first night
of the operation, and thus disturbed lenses
of the operation, in the remaining case, the surgeon left instructions that the exocrine drops should be reapplied two hours after the operation, and after the bandage and pads were not carefully removed and every precaution taken, a perforation of the iris occurred, which was in doubt due to the opening of the eye to reapply the exocrine drops, thereby the cicatrix of the wound was disturbed. In two cases, slight adhesions occurred, but in all the cases with exception, the adhesions were broken down by means of a strong solution of atropine, and in the remaining case the iris became adherent to the cataract, and it was thought advisable to perform an iridectomy, as Dr. Sue F. and the patient A were free from recurring attacks of iritis.

In one case only, atrophy of the eyeball took place, and the eye was too far an organ of vision; the patient was a weak unhealthy woman, and although there was no trace of sugar or albumen in the urine, still her general health was not satisfactory. And being a poor woman, she was weak from want of proper and nourishing food.
In the statistics of the 140 cases in which an iridectomy was performed previously or in connection with the extraction of the cataract, loss of a portion of the vitreous body took place in five cases, the same number, as when an iridectomy was performed, thus showing that there is no material difference, in the two forms of operation, as regards the frequency of this complication. Cataract less matter was left in as many as 2 cases, which involved a slighting operation one week later, and this record compares favourably with that of the previous operation, as it is more easy to remove the whole of the cortical substance, when the bleb is made in the iris below the incision. In five cases an iritis resulted after the operation, and in two cases the iris became adherent, and thus required a further operation to form a fistula. But in the remaining cases the inflammation was reduced by means of Atropine. This favourable result is recorded as regards the ultimate vision of the patient. Panophthalmitis resulted in 3 cases.
and in each case the eye was left, in two
removal of the eye was repeated in one the
7th and 9th day succeeding the operation,
and in the other case, the suppuration
was kept under by means of iodine
saturated with the eye thrice daily,
but as an organ of vision the eye was
guise beyond repair, as the anterior
chamber was occluded with organized
leukia, and the cornea very cloudy.
From the frequency of hypopyon following a cataract extraction when
accompanied by an iridectomy, it appears
that the operation in which the iris is
left intact has some advantages over it; as, in the same number of cases only
one was recorded, while 20 iridectomies
were performed, so that the danger of
absorption of septic matter appears to be
greater, and the results are more to be
feared as regards the success of the operation.
It is needless to add that the same
antiseptic precautions, as regards instruments
and dressings etc., were taken in all
the cases, and the eyes were all bathed
with a saturated solution of Boracic acid
before the operation. The lids washed
with the same solution after it.
The arguments in favour of the modified lacerated or direct extraction of hard cataract, without an iridectomy, are much discussed by all the ophthalmic surgeons, and a account of the varied opinions, as definite rules have been laid down as to practice. The dangers do not appear to be more than when an iridectomy is performed. The only dangers being the prolapse of the iris, and this is of rare occurrence, and with some precautions, this practice also can be taught, might be rendered even less liable to happen, but even after its occurrence, no severe pain or distress is complained of as a rule, and in all the cases that have come under my care, after the removal of the protruding mass, the eye has healed up. I have been as satisfac-
tory as if an iridectomy had been performed with the operation of extraction, and so this, in itself, it cannot be accounted as a reason why an iridectomy should not be performed with the extraction. 

The circular pupil which is capable of accommodation, and which is of such great help in cutting off the rays of light, and thus rendering the vision more satisfactory is a great point in favour of the simple
extraction, and it is also clear that the astigmatism which results so frequently from cataract extraction, is of less degree, and in every way more favourable for the lens correction, than when an iridectomy is performed; in fact, Dr. Slezowski, the eminent Russian oculist, affirms that it is necessary to use cylindrical glasses in nine cases out of ten, when an iridectomy has been performed, of at least 1.25 diopters, whereas he affirms that when the iris is left intact, his patients uniformly refuse the cylinders, and that in only one case out of 10 an astigmatism is found, and that rarely of a high degree; this fact is a great argument in favour of the operation without iridectomy.

The appearance of the eye is also well worthy of consideration, as a round pupil is much more comely, and the shape of the pupil when a large iridectomy has been performed is in many cases distressing to the patient. The number of patients in which cataract results from the extraction without iridectomy is very small, and it is surprising to what great extent this delicate muscle can be stretched and displaced, without any apparent harmful results.
It is appears to be quite as frequent after the operation where iridectomy was performed, both, by the statistics of the 100 operations from which I drew my conclusions, and also from those of the eminent French oculists. It is De Becker and Salezowski, who both affirm, that iritis, iridocyclitis and excavation of the eyeball, are more liable to occur than when no iridectomy has been performed. Loss of the vitreous humour does not appear to be more liable to occur during the extraction without iridectomy, and after the evacuation of the internal layers of the lens is slightly more difficult, it appears as if the iris kept the vitreous humour from bulging forward into the anterior chamber, and thus rendered the entrance of the curette into the anterior chamber a little easier. It leaves any of the matter left there in, an easy. Therapeutically safe adjacent to the successful termination of the operation. From these statistics it appears that, when the cataract is not complicated by adhesions of the iris or symptoms of increased tension, that it is a safer and more satisfactory operation to perform the modified linear extraction without an iridectomy.
In speaking of the Astigmatism which is so often found as the result of cataract extraction, especially after an incision has been performed; it appears to result, according to most authors, from the cicatrix of the incision, which apparently draws the cornea in a vertical diameter, or else the edges of the wound may not be apposed accurately, and thus in some cases a troublesome irregular astigmatism results; but in most cases the astigmatism is in the vertical diameter. Thus requires cylindrical glasses placed with the axis horizontal, so as to correct the unequal curvature of the cornea.

After cataract extraction, there is in some cases not of ten a certain amount of corneal astigmatism, but the amount varies through a large degree, between 1 and 3 Dipters, and in many cases the patient prefers the spherical glass close as correction, as he finds the cylinder confuses his vision. I am trying for him to wear.

In rare cases, a patient, who has had a certain amount of astigmatism previous to the cataract extraction, has apparently had the astigmatism corrected by the operation.
The result of astigmatism due to the extraction of cataract, does not appear to bear any definite relation to that, which were found before the extraction was practiced, and the results vary through such large amounts that there is not present, so method by which they can be foretold.

In these rare cases, where an eye has been markedly astigmatic previous to the operation, and in which the astigmatism is lowered or even removed apparently by the operation, it is possible that the astigmatic error was due to the lens itself, and that the removal of the lens, did not cause any corneal astigmatism. Therefore, the absence of the astigmatism might be accounted for by the absence of the lens. Or, it is possible that the astigmatism, having been previously in the horizontal axis and due to the cataract, the cicatrix of the incision, might have rendered the vertical and horizontal axes less abnormal, but this must be accounted as an accident. There are some cases in which the amount of astigmatic error is not altered in any appreciable extent, but the axis may be exactly the reverse after the operation, than it was previous to it.
Again, astigmatism may be increased in amount and remain in the same axis or even be in a different axis, and the amount markedly increased.

The astigmatism resulting from the extraction or removal by traction of soft cataracts, does not differ from that which follows the extraction of the nucleus cataradis, but is the incision is likely to be smaller so the cataract does not alter the surface of the cornea to such a marked extent, and thus the amount of astigmatism is usually small unless an iridectomy has been performed, or a large corneal-sclerotic incision has been made for the evacuation of the lens matter.

But in many cases of soft cataract due to an injury, where the cornea has been wounded, and the iris entangled in the wound, a large amount of corneal astigmatism is often the result, which may cause the patient great inconvenience as regards the future vision, and may thus seriously interfere with the ultimate successful results of any operation performed, especially if the astigmatism is irregular, as, so often the case, when caused by injuries to the cornea or ulcers for stating in which the iris is complicated.
As the estimation resulting from the modified linear extraction of cataract without iridectomy is markedly less than that which results when an iridectomy has been performed, and the vision obtained by a circular flap is in all cases so much inferior to that when the flap is distorted or irregular, I think it is one of the chief arguments in favour of the operation without iridectomy except in those exceptional cases where there are any adhesions between the iris and lens due to previous inflammations, or in those cases where on account of the large size of the lens, the iris is bruised or torn during the extraction, especially as these do not appear to be any increased danger for the patient by leaving the iris intact, since the introduction of cocaine into the ophthalmic surgery, and the application of cocaine drops immediately after the conclusion of the operation, before the eyes are closed and bandaged, is as to prevent the prolapse of the iris into the wound. I have also remarked that as a rule the after pain endured after the operation is in most cases less, both in acuteness and also duration than when an iridectomy has been performed.
As the result of these investigations, I think it is natural to infer, that there is a distinct relation between astigmatic errors of refraction and the occurrence of senile cataract, and that astigmatism is a predisposing cause of the degeneration of the lens, especially if of high degree, as the cataract appears, uniformly, at an earlier period of life. There is connection with high degree of astigmatism; and in all cases, as yet recorded, the degeneration of the lens is most advanced in the most markedly astigmatic eye, when the degree of astigmatism vary in the same individual. The way in which the astigmatism actually interferes with the healthy nutrition and condition of the lens is not at present definitely understood; but the surrounding tissues are so delicate, that it is natural to suppose that even slight variations and irregularities of pressure would have an injurious action upon its healthy state, and so in cases of astigmatic error, where the ciliary muscle undergoes irregular and spastic contractions in order to improve the vision of the patient, the lens would be subjected to variations of pressure which might
have an injurious effect upon its healthy condition, just as a cataract is often caused by a shock from a blow upon the head, which leaves no intraocular injuries that can be detected on examination even after the occurrence, but gradually a cataract results; it is only natural to suppose that some slight dislocation of the lens has resulted, by which its healthy nutrition has been impaired, thus making it sensitive to the slightest disturbance the surroundings of the lens may be; and from this Peyer that the variations of pressure so often brought about by the unequal and variable contractions of the ciliary muscle, in the efforts of accommodation, when any considerable degree of astigmatism exists, are also sufficient to act in an injurious manner upon the health condition of the lens, and may thus be a cause of cataract.

The proper correction of astigmatic errors, will thus become doubly important and necessary in order to render the ciliary muscle as free from strain and unequal contractions as possible, and thus bring the vision as close to the
ensures the standard as possible, thus doing all in our power to remove the cause which predisposes in such a marked manner to the formation of cataract; and to obtain the end, it will be necessary to have the accommodation thoroughly paralysed by means of some medication during the process of examination and testing the refraction, so as to put out of the question all sources of error due to the accommodation of the eye; and by this means we may hope, if we try to prevent, at least, to delay the formation of cataract in the lens substance.

The investigations concerning the predisposing causes of cataract are necessarily unsatisfactory, on account of the length of time over which they must extend, and of an essential condition of the intraocular circulation, i.e., recognized as a predisposing cause, there it becomes necessary for the Ophthalmic Surgeon to deal in his power to prevent this state of intra-ocular disturbance coming into play, and thus in all errors of refraction the endeavours must be to render the sight as near to the Normal, by means of lens as lies in our power, and quite as trouble in order to correct complicated Astigmatic errors,
so that we may carry out the principle of the old adage, with regard to the formation of cataract that prevention is better than cure.

"The end"