

A STUDY OF THE CHANGES  
FOLLOWING UPON  
EXTRACTION OF CATARACT  
WITH A HISTOLOGICAL REPORT OF  
THIRTY CASES.

THESIS

BY

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For the material for the following Thesis, I am indebted to Prof. Fuchs, who most kindly placed his collection at my disposal, and also to Mr Richardson Cross to whom I am indebted for Cases XVII and XXXIII of the series.

The cases examined, thirty-three in number, were all cases free from septic infection, and therefore normal in so far as the process of healing goes. In twenty-one cases, death supervened in a period of from three days to a month from the date of operation from some inter-current affection, while four cases were enucleated for pain and secondary glaucoma, and eight are from P.M. cases.

It is from an examination of these cases that the following remarks on the state and condition of the Aphakic Eye from an Anatomical Standpoint are based.

The Incision.

Before Graefe's time the operation for extraction of Cataract was always performed by means of a corneal Flap Incision, following upon the lines of

Daviel's Classic Operation. Graefe, however, in that operation which to this day bears his name, modified it so in form and position that the section came to lie altogether in the Sclera. The modern incision may be described as a compromise between these two extremes for while in form it is a Circular Flap, in position it lies in the Corneo-Scleral Margin.

The external relations of the incision which we shall see later are very important as regards the subsequent process of healing, are given as follows by two high authorities:- (i) "The Incision between puncture and counter-puncture lies in the clear cornea at its very margin." (Swanzy).

(ii) The Section divides the Cornea just in the Limbus. (Fuchs). That is to say, in the former case, the Incision lies altogether in the cornea, while in the latter, the section goes through the subconjunctival tissue and Conjunctiva of the Limbus and necessarily often comprise a Conjunctival Flap.

The Internal Relations of the Section in the flap operation are very constant.

Measurements of the inner margin of the Incision taken at the centre of the Coloboma show that the distance of the inner end of the incision from the posterior end of Schlemm's Canal - as

being the nearest fixed point from which measurements can be made, and which from a practical point of view can be considered as equal to the Angle of the Anterior Chamber, varies from 2.66.m.m. to 1.54.m.m. (vide Table), while in the case of the much more peripheral Graefe's Linear Incision, the distances are much less and vary from 1.82 m.m. to a distance of only .364 m.m.

The Plane and Direction of the Incision varies very much in different cases, and in fact in different parts of the same case. The first part of the incision, comprising puncture and counter-puncture, runs parallel to the Iris plane; but owing to the different factors that come into play, when the section is being completed, the obliquity with which the section runs through the cornea varies; and this would appear to depend very much on where the incision is finished and how the knife is brought out.

In consequence of the very peripheral position of Graefe's Section and also from the method of its formation it runs much more perpendicularly through the Sclera at the centre of the Incision while at either end of the wound at the puncture and counter puncture the direction runs much more obliquely. Case XV, 3 figs.

Irregularities and unevennesses of the opposing surfaces of the incision are not uncommon results of the sawing motion with which sections are often completed giving the wound a wavy or step like appearance as in Case II etc.

Another result following from the same cause is a notching of the Lip Margin. Such an appearance is shewn in cases X and XI where in consequence of the knife taking a new direction, a notch or diverticulum has been formed in the Superior or Scleral Margin of the incision.

There is one important point to be noted when considering the Direction and Place of the Incision, and that is the Relation of the Cut Surfaces to each other. As is well known the result of making a vertical incision through the Corneal Lamellae is a retraction of the Anterior and Posterior Layers leaving the central part of the Wound in contact so that the lip wounds instead of appearing as a straight line show two curved surfaces meeting and touching at the middle though more often somewhat nearer the Posterior surface than the centre of the Wound, resulting in the formation of two triangular spaces with bases respectively in and out instead of a linear gap.

Owing to the oblique nature of the Incision

and its position at the Corneo-Scleral junction this appearance in extraction wounds is modified and not so evident. Besides this retraction of the Surfaces there is the tendency to be found in early cases uncomplicated by prolapse of Iris or other foreign substance between the lips of the wound - for the central or Corneal Flap to overlap or over-ride the Scleral - and this is especially the case in Flap Incisions - Cases I, II, etc. Where there has been some incarceration of Lens Capsule or Iris preventing as it does the Lips coming together the cause of this over-riding as well as the gaping of the wound is easy to understand; but where no such influences come into play, as the separation of the two lips of the wound by the hard Nucleus in the act of extraction can have but the most temporary influence, this gaping of the wound has been explained as the result of the intra-ocular tension which acting on the point of least resistance, i.e. where the incision has been made forces the more movable corneal flap outwards, otherwise forwards. But if the Intra-ocular tension were the only factor, then one would expect the forward displacement to be a more constant feature after section for cataract, which is not the case, and therefore the gaping of the lips of the wound has been explained as the result of the

extensive Corneo-scleral incision, occupying as it does a third of the Corneal Circumference, freeing the corneal lamellae from their state of normal tension and so allowing them to spring forward, this being most marked as might be expected at the centre of the incision. That this fails to occur in many cases is not to be wondered at considering the comparative rigidity of the tissues, in consequence of the age at which most cataract cases are operated on, and likewise from the fact that in cases where the section runs perpendicular to the surface as is the rule in Graefe's Operation such a displacement forward can not so readily take place, not only owing to the fact that the margins of the wound cannot glide past each other so easily but also that the incision runs in the more rigid Sclera. An exception to this will be noted in Case VII operated on after Graefe's method where there is a considerable forward Displacement of the Cornea though it will be noted that the section runs obliquely through the Sclera. It is possible that it is a combination of different factors that come into play to cause this spring forward of which the elastic nature of the Cornea and the Intra-ocular tension are the chief, aided however by the oblique nature of the incision. The influence of this sliding past of the edges of the wound in

the subsequent process of healing will be discussed later.

#### The Healing of the Operation Wound.

While the processes of repair following incisions of the Cornea - operative and experimental - have been studied by numerous observers, yet, possibly from the natural difficulty of collecting material the corresponding changes following upon the incision for Cataract have not been adequately described.

The importance of the Position of the Incision in producing modifications in the subsequent process of healing must first be emphasised, and therefore one must clearly differentiate between sections lying in the Clear Cornea, and those in the Sclera or Corneo-Scleral Junction. In the former class the type of healing is similar in every respect to that following a corneal wound, while in the latter class where the section lies in the Limbus the healing process is modified, owing to the rôle that the Subconjunctival Tissue plays in it, so that it becomes here analogous to that followed by Perforating Scleral wounds in which, as first pointed out by Lubinsky, the Scleral Fibres play a secondary part, as the reparative Tissue Cells are supplied by the active proliferation of extraneous tissue especially the Episcleral.

Briefly the changes that follow on a Corneal Flap Incision are as follows:-

The first step in the process of healing is an outpouring of Fibrinous exudate which glues the lips together and fills up the gap in the cornea where the distance between them is least, which is about the centre. This coagulum (aided as it is by the swelling of the corneal Parenchyma by the Inhibition of Aqueous) is sufficiently strong to retain the Aqueous and so allow of the restoration of the Anterior Chamber.

Whether the coagulum formed is derived from transuded fluid from the severed corneal lamellae or whether it is formed by the newly exuded Aqueous it has not yet been finally settled; but at any rate it has been experimentally shown that the aqueous formed after a paracentesis contains Albumin and Fibrin not present normally.

The next step in the Process of Healing is taken by the Corneal Epithelium. Gutterbock (25) was the first who pointed out the important rôle this plays in the closing of Corneal wounds. He thought, however, that the Epithelium got carried into the wound by the edge of the knife, but as this in the operation for Extraction is carried from within out his hypothesis can scarcely hold.

Neese (23) experimentally studied this epithelial down growth in rabbits and found that one

hour after an incision with Graefe's knife numerous mitotic figures were present in the Epithelium surrounding the wound. Four hours after, this had started to grow down both surfaces of the incision, and by the 12th hour it had descended half way down; by the 15th the Epithelium of both lips had joined while during the next 24 hours the depths of the wound became filled with Epithelial Cells which gradually reached the surface.

Peters (30 and 31) also studied the changes in both the Epithelium and the Endothelium of the Cornea after wounds but failed to make out the early and marked Karyokinesis described by Neese as appearing within the first hours after the incision, and points out that many more cells lie in the lips of the wound than can be accounted for by mere cell division of the surrounding Epithelium. He therefore considers that these Epithelial Cells which first cover a break in the continuity of the Epithelial Layer get there by active Amoeboid movement and not till after this active immigration of cells does the factor of cell division come into force.

Ranvier (18) agrees with Peters in affirming the Proliferation of the Epithelium in the early stages plays an unimportant part, as the mitotic

figures are in the beginning absent, or few in number, and late in appearing. He however, considers the in-dipping quite a mechanical process and following as the result of the cells of the corneal epithelium lying under normal circumstances under a certain tension - "like balls in a sack" so that when one withdraws the support at one point, as would follow in consequence of the incision, the cells naturally fall into the Wound. An application of the law of gravity which appears somewhat difficult to apply, especially in the case of a single layer such as the Posterior Endothelium.

In Man this Epithelium ingrowth does not appear to be anything like such a rapid process as in rabbits for it would appear to take about three or four days before the Epithelium of the two sides has united, though this depends on the extent of the Surface over which the Epithelium has to grow, before it meets that of the opposite side. The time in which this is accomplished will vary according to the greater or less extent to which the interval between the two surfaces has been filled by the fibrinous exudate or by the contact of the wound mass between the lip surfaces.

Where the wound gapes however so that there is no obstruction to the continued ingrowth of the surface epithelium this may continue spreading

along the surface of the wound into the Anterior Chamber as has occurred in Cases I and XVII conditions which would have led subsequently to the formation of Anterior Chamber Cysts such as have actually formed in Cases XXXII and XXXIII.

The most important factor however in the rate of production of the Epithelial Plug is the Vitality of the tissues of the subject. In young rabbits, as pointed out by the observers cited above, the process is extremely rapid, while in man, especially at the age at which cataract extraction is performed the personal factor of vital activity plays an important part. This is well illustrated in the Cases I and XVII in both of which the surface Epithelium has reached the same point i.e. it has just turned round the inner margin of the wound yet in the first case this has only taken three days to accomplish while in Case XVII it has required 27 days.

While the stratified epithelium on the surface of the cornea is growing down the outer extent of the wound, the Endothelium on the posterior surface by a similar process lines the inner aspect of the incision to the completion of Primary Union.

Peters points out that there is complete accord as regards the regenerative processes, between the single layer on the posterior aspect and the

stratified Epithelium covering the surface of the Cornea. In both there are two regenerative processes following on each other; firstly a Provisional covering following as the result of active and amoeboid movement of the surrounding cells and secondly the Epithelial Layer proper derived from cell division.

He states that the length of time required for the Regeneration of the Endothelium varies - Small defects are covered in 3 - 4 days, larger up to 10 days. Up to 6 days no mitotic changes are visible so that the only covering at first is due to the immigration of Endothelial cells, which is possibly the cause of the delay and arrest of the cell division.

The Primary Union of a Corneal Flap Incision is therefore completed without the Parenchyma playing any part in it whatever, and judging from the cases at hand it is certainly not before the 16th day that the Corneal elements proper show any sign of activity. In time owing to pressure the Epithelial ingrowth, atrophies and disappears, and in from two to six weeks a firm and permanent cicatrix is formed, the exclusive product of the Corneal tissue whose course it is scarcely possible to follow in its entirety.

Far otherwise is the healing Process when the

extraction wound goes through the Corneo-scleral junction or the Sclera as in Graefe's extraction, since here we have a wound of the subconjunctival Tissue as well as Conjunction. The Conjunctival or Limbal Flap soon becomes agglutinated preventing thereby the surface epithelium descending deeper, as is seen in peripheral sections of Case I. The subconjunctival tissue owing to leaking of the wound becomes oedematous and at the same time, as in the case of Corneal Wounds, the gap between the lips if not too large is filled by a fibrinous plug.

In Scleral Sections the closing up of the gap between the Lips of the Incision is brought about by a downgrowth of the subconjunctival Tissue. This downgrowth however does not appear to start till after the third day, to judge from the cases of that date in the series, where no attempt had yet been made by the subconjunctival tissue to grow down between the lips; the regenerative process being possibly delayed by the oedematous swelling of the tissues. By the seventh day however, as in Cases V and VI the Connective Tissue has grown well down both surfaces of the wound and so brought about Primary Union. This Primary Union therefore as in the case of the Corneal Section is brought about by tissues which have no direct connection with the Corneal Parenchyma.

Blood vessels as in the case of all actively growing tissues are present in increased number at the Limbus and are likewise to be seen making their way down along with the Connective Tissue downgrowth, which as might be expected from its more favourable situation, is chiefly derived from the subconjunctival Tissue over the more distal or scleral Flap as is well illustrated in Case VII. In consequence of their origin the cells forming this downgrowth at first lie with their long axis parallel to the wound and therefore perpendicular to the surface. This appearance lasts till the end of the third week at any rate; the only difference being that by that time the Posterior Epithelium has possibly bridged over the defect at the inner margin of the Incision.

In the course of healing these interpolated connective tissue cells come to take up a position at right angles to their original course and lie with their long axis parallel with the corneal lamellae, resulting in a cicatrix which is a much more distinct and marked one than that following a purely Corneal Incision. It is always broad, and the fibres comprising it do not form the same broad and regular lamellae of the normal sclera, but run in finer bundles and in a rather irregular manner from surface to surface - so that the cicatrix can

always with the greatest of ease be made out throughout its extent. The blood vessels, which have made their way down along with the Connective Tissue downgrowth and which play such an important part in its nutrition, become in the subsequent contraction of the scar pressed upon and obliterated, though a few may still remain patent while others may be seen as empty tubes in the course of the cicatrix.

The relative inactivity on the part of the Sclera in the healing Process must not be ascribed to any inherent mal-development of the power of reproduction by its cells but to the absence of Blood vessels in it, so allowing the dominating formative action of the subconjunctival tissue, on account of its vascularity, to play a more important part in its regeneration and permitting of the wound space being filled up by a connective tissue derived from other sources, for when this is prevented, as pointed out by Kruckmann (26) by stripping off the episcleral tissue, the sclerela will in time exclusively take up the reparative function by a process which is therefore comparable to that by which the Cornea is finally healed. This also takes place in these Scleral Incisions, where owing to good apposition of the cut surfaces, there has been no gaping and consequently no opportunity for

the subconjunctival tissue to enter into the Wound, which becomes firmly united by direct union without the interposition of any intercalary mass derived from outside sources.

As a counter-part of these cases of Corneal Incision, when the surface Epithelium has grown into the Anterior Chamber, one finds that given the opportunity the Subconjunctival Tissue in Scleral Sections will do likewise. Normally this stops after it has reached the inner margin of the Incision, but in cases where the Anterior Lens Capsule is prolapsed the Subconjunctival Tissue makes its way down both its surfaces and becoming attached to the Posterior Capsule pulls it forward - Vide Table IV.

Post Operative Astigmatism.

Among the most important results directly bearing on the healing of the Wound is that of Post-Operative Astigmatism.

Donders first described, in 1864, this Astigmatism as following in consequence of the cicatrix altering the curvature of the Cornea.

That it directly follows upon the Incision is a well-known clinical fact, though why it should result, and from what direct cause, are still disputed points. The clinical facts established are:-

(I) The direction of the acquired astigmatism is always dependent on the position of the Incision which causes a flattening of the Cornea at right angles to the wound, with an increase of curvature parallel to it.

(II) The more regular the cicatrisation, the less marked is the Astigmatism.

(III) It is said to be less after a linear incision made with a Keratotome or after Graefe's extraction than it is after a flap operation.

(IV) The Astigmatism reaches its maximum very shortly after the operation, after which it begins to diminish slowly till a permanent amount is reached, but its rate of diminishing is not regular. Jackson (11) states that in only 15% of extractions is a permanent amount of Astigmatism reached by the second month; in 60% this is reached between the second and third month; while in 20% the changes are continued after the third month.

(V) The regularity of the Astigmatism depends on whether there has been any prolapse, adhesion, or incarceration of Iris or Lens Capsule. The influence of such complications on the amount is considerable, and is proportional to the involvement of the wound, so that a large incarceration is worse than a small prolapse in tending to delay and hinder the diminution of the Astigmatism.

To account for all these clinical manifestations and observations of Post Operative Astigmatism, many theories have been put forward but very few facts. The action of the eyelids on the eyeball, it has been suggested, would account for the change of curvature of the Cornea. Compression of the Cornea by the lids, however, produces increased curvature in a vertical direction, which is just the opposite condition as found after extraction performed upwards, besides which it is a condition that can be produced in the normal eye by simply screwing up the lids. The extra-ocular muscles, especially the internal and external recti, also have been supposed to influence the curvature of the Cornea.

Jackson considers the development of the Astigmatism following on Extraction to result from the Intra Ocular Pressure, which is most felt at the Incision, where resistance is least so that it protrudes.

Considering that Post Operative Astigmatism, follows upon an Incision, it is certainly in the condition of the wound itself that an explanation of the phenomena must be found. While in only one Case, No. XXXIII of the Series is there a history of Astigmatism following extraction, yet there are enough data to warrant the assumption that in the wound, and only in the wound, is to be found an explanation for the changes in the Corneal curvature

so marked in some cases, and one which will explain all the clinical observations cited above.

When discussing the relationship of the wound surfaces to each other, it was stated that after extraction there was a great tendency for the Corneal Flap, especially if the incision ran obliquely, to spring forward and overlap the scleral margin. This overlapping and gaping of the wound being more marked at the centre of the incision, it follows that it will be here that the greatest amount of connective tissue downgrowth will occur when the incision lies in the limbus.

Now the result of the introduction of such an intercalary mass between the wound lips can only be the conversion of what might, but for it, have been a temporary, into a permanent diminution of curvature in the vertical meridian; for the introduction of a wedge such as this into the segment of a circle will result in an increase of the radius of curvature of the latter, which in the course of time will diminish, as the wound consolidates and brings the edges of the wound closer together, hence the slow decrease in the Astigmatism that, for the next two or three months follows the operation.

When the wound is entirely corneal so that there can follow no downgrowth of connective tissue, or when no displacement of the lips has occurred,

perfect apposition will follow resulting in the space between the cut surfaces being reduced to a minimum so that the normal radius of curvature is maintained.

The rôle that foreign matter, whatever its nature, plays when inclosed in the incision is that by keeping the lips of the wound apart, it aids the downgrowth of the limbal tissue, hence the clinical observation cited above that the influence, on the subsequent Astigmatism, of a prolapse is proportionate to the involvement, as a large incarceration is worse than a small prolapse, owing to the extent of the surface of the wound influenced being greater.

In the Cases examined the interspace present between the two cut surfaces varied, from nil to as much as .68 m.m. in Case XI, which is an amount which must influence in a most marked manner the curvature of the Cornea.

#### Descemet's Membrane.

Descemet's Membrane, being a purely passive structure derived from the cells of the Posterior Endothelium has no recuperative power, and so it comes about that sections through the membrane are always seen with sharp and clean cut surfaces no matter how old the case may be, besides always

showing the direction in which it was cut. It therefore follows that the more perpendicular to the surface the Incision has been made as in a Graefe's Incision the more rectangular will the section through Descemet's Membrane appear, Case XXVIII, etc., while the more obliquely it runs, the greater will be the obliquity of its cut surfaces, Case II etc.

It was on this account believed at one time that Descemet's Membrane was never reformed until Wagemann showed how it was regenerated by the Endothelial Cells, which, as we have seen above, creep along the inner margin of the lip-wound, and so come to seal the inner extremity of the scar in an analogous manner to the down-growth of the surface epithelium, and in the course of time lay down a new Membrane which bridges over the space existing between the two cut ends of the original Membrane, as is illustrated in Case XXVIII.

Becker in his Atlas of Pathological Topography of the Eye illustrates several extraction wounds in which in the Upper or Scleral Flap, Descemet's Membrane projects beyond the cut Scleral Fibres, but he does not comment on the fact. I found a similar condition in 17 of the 33 cases examined, and the amount varied from .01 to .35 mm.

This Projection varies very much in different

cases and in fact in different sections of the same case (Case II) so that it would appear to depend directly on how the incision is formed, rather than on any contraction or retraction on the part of the Membrane or Corneal Fibres - for where the Incision runs perpendicularly through the Cornea there is no apparent projection of the scleral portion of the Membrane but both are cut square and flush at right angles to the Surface of the Cornea; while the more obliquely, the incision runs the more pronounced does this tag of Membrane on the Superior lip become. Further, if present, this Projection only exists at the centre of the Section, i.e., at that part where the Graefe's knife is turned to cut outwards for it is not to be made out in Peripheral Meridional Section of the Incision, cut either vertically or horizontally, where the Puncture and counter-puncture lie, for here the Corneal Lamellae and Descemet's Membrane are severed in one direct line (Case III) but approaching the Upper Arc of the Corneal Circumference the knife, if the incision is to run obliquely, will strike Descemet's Membrane obliquely and then, meeting the deeper layers of the Cornea, will push them slightly before them or will slip along a little before gripping and going through and so form the small

flap of Descemet's Membrane on the Scleral Lip of the Wound.

In some cases, Descemet's Membrane may be broken or stripped off for a short distance from one or both margins of the incision. The most marked cases of this condition are V. and VI.

In them Descemet's Membrane at both sides stops short of the incision, while over the denuded and exposed Corneal Fibres the Posterior Endothelium is making its way along to cover the defect.

#### The Iris.

As a necessary consequence of the Peripheral Position of Graefe's Section the formation of an Iridectomy, as a routine part of the operation for extraction, became necessary to prevent incarceration and prolapse of the Iris. With the modern flap incision this is not, according to some authorities, such a necessary procedure though the battle is still raging over the subject. In my series of Cases there are only four out of the thirty three Cases where simple extraction has been performed, and of these only two show a perfectly successful result with Iris free and in one Plane while the remaining two show slight incarceration of the Iris in the wound, which in all the cases is a corneal one.

In the performing of an Iridectomy it is not that part of the Iris, which is seized by the forceps and pulled out of the wound and then snipped off, that alone is subjected to traction but the whole Iris system is put on the stretch, and feels the resulting strain. For as the Pupillary Margin is drawn upwards by the forceps a strain is put on the whole of the Sphincter Pupillae as also on the root of the Iris circumference. The consequence of such a strain, on a frail structure as the Iris, is that small ruptures of its surfaces, both anteriorly, both at the root of the Iris stump forming the Coloboma, and also in the Iris below are a common occurrence after an Iridectomy; as also are breaks or ruptures of the Dilator Pupillae, Displacement of the Sphincter Pupillae, Detachment of pigment, and minute haemorrhages, all of which will be treated more in detail further on.

The amount of the Iris removed in forming the Coloboma varies; as a rule in the modern flap incision from  $\frac{3}{4}$  to  $\frac{4}{5}$  of the vertical depth of the Iris at centre of the Coloboma is removed, though the exact amount, it would appear, depends on the position of the Incision for the more peripheral the incision lies, the smaller will be the stump of the Iris left behind. The average in those

cases where the stump of the Iris had not been torn in performing Iridectomy was 1.3 mm. In Graefe's Sections however, the size of the Iris stump left behind is still smaller, and in no case exceeded 1 mm. Table I.

In the great majority of the cases it will be noticed that the cut surface of the Iris stump is severed obliquely so that the anterior surface appears longer than the posterior. This appearance is possibly due to the way the Iris lies when cut pulled backwards as it is through an oblique section and then cut tangentially to the cornea. On the other hand the natural elasticity of the posterior Limiting Membrane or Dilator Pupillae may be the cause of the cut surface assuming an oblique appearance, but not in all cases for in some where the Dilator has been torn across as in Case XXVIII. or even pulled out altogether as in No. XXIII. the cut Iris stump still shows a larger anterior than posterior surface. That however the Dilator may have some action in producing this appearance is suggested by Cases XXVI. and XVIII where it would appear as if the Dilator, having full play, had pulled the cut surface so that it faced posteriorly.

It is a clinical observation of long standing that in making an Iridectomy on healthy Iris there

is little or no visible haemorrhage. As might be expected, on making a microscopic examination in early cases minute haemorrhages at, and near, the cut surface of the Iris are not infrequently visible, even as late as the 15th day after the operation as in Case XII.

What can not but strike one when examining a series of cases such as these, where the healthy Iris has been operated on is the extraordinary amount of Trauma that can be exhibited in it without leading to any reaction.

It would almost appear as if the Iris tissue was absolutely indifferent to such, as long as there are not introduced toxic or septic agencies. For normally it makes no reparative processes, no scar is formed when its tissue is divided or torn, no connective tissue is layed down when it is pulled out from the Ciliary Body, and no reaction follows haemorrhages into its substance, which although they become absorbed in time, do so very slowly, with which exception the Iris tissue remains exactly years after the operation as it did immediately after it; for the cut surface will remain as when first severed - the Anterior Limiting Membrane having no tendency to cover it, or the Pigment Layer to grow over it, and no Wandering Cells cover its surface with connective tissue - consequently this

surface has a great tendency to adhere to anything with which it may come in contact especially broken Lens matter.

Extravasation of blood is however not limited only to the cut surfaces of the Iris, but they are also frequently met with at the Root of the Iris Stump, and likewise at a corresponding point in the Iris inferiorly; and although much more constant if the Iris has been torn, yet it is not at all infrequent to find minute extravasation in these positions in early cases without any other marked signs of trauma; arising possibly, simply as the result of the stretching of old and inelastic capillaries, Such extravasations are to be found at the junction of the Iris with the Ciliary Body extending along the anterior aspect of the same, but never present in the substance of the Ciliary Muscle. Extravasations in this position were present in five cases; in some they were more marked at the Root of the Iris Stump superiorly, while in others they were only present at the Root of the inferior part of the Iris ring, i.e. at a point opposite to the Coloboma. Another point where extravasation of blood into the Iris tissue would appear to be even a more frequent occurrence is in the Pupillary Portion of the Iris, just external to the Sphincter

Pupillae, along with which may be associated some extravasation lying on the surface of that muscle. Extravasations in this position were present in seven early cases (Table II.) varying in date from 3 to 22 days after operation, which cases comprise the five above mentioned ones where haemorrhages were present at the Iris Root. The presence of these haemorrhages at the Pupillary Part of the Iris can only be explained by the traction which the Sphincter Pupillae sustains as it is pulled upwards by the forceps, resulting in a strain which is felt throughout the whole circumference of that muscle, and manifesting itself in these minute extravasations and in Case V. as an actual dislocation of the Sphincter from its bed. This strain is likewise felt by the Iris at its attachment to the Ciliary Body, where its structure is thinnest, and it is therefore here that, as mentioned above haemorrhages are not infrequent, while between the External Margin of the Sphincter Pupillae and the Iris Root in no cases were extravasations present. Also arising from the same cause, namely, the direct pull on the Iris, must be ascribed the frequency with which tears and lacerations of the Iris are met. These are to be found without exception at the junction of the Iris with the Ciliary Body and

vary from slight rupture of the Anterior Limiting Membrane to partial or complete Detachment of the Iris. Such changes are found not only in the Stump superiorly but also in the rest of the Iris Circumference. In only one case was there Iridodialysis inferiorly through complete detachment of the Stump of the Coloboma or even its complete absence was by no means uncommon. A frequent form of Partial Detachment to be found especially in the Stump of the Iris left after an Iridectomy is Rupture of the Dilator. This was broken across in four cases while in other two the Dilator was completely detached leaving the Iris Stump denuded altogether of its Posterior Layers - and this without apparently causing any great disturbance wither clinically or histologically.

It is no doubt due to these haemorrhages and lacerations that the slight transient iritis so often following cases of extraction must be ascribed.

Prof. Fuchs (5) has lately laid great stress on these lacerations at the Iris root, for, as he points out, the consequence of these rents is a free communication between the fluid in the Anterior Chamber and the Tissue of the Ciliary Body whereby fluid is asperated into the Supra-Choroidal space so leading to detachment of the Ciliary Body and Choroid; a

result which the age of the patient, and therefore increased rigidity of the Sclera, aided by the section being made with a Graef's knife in consequence of which the Sclera is dragged upon at the time of operation, all possibly play a part in producing.

Prof. Fuchs states that Detachment of the Choroid is met with chiefly in the Temporal and Nasal sides; while Detachment above and below are rare, and only met with along with lateral ones.

In Table III. is given a list of the cases in which Detachment of the Choroid was present. These eight cases with the exception of Case III were all sectioned vertically and they all show detachment, more or less extensive, of the Ciliary Body and Choroid superiorly as well as inferiorly. The most marked case of Detachment is Case XVII where it extends as far back as the equator of the eye, above as well as below.

The Posterior Pigment Layers like the other structures composing the Iris play a very passive part under normal circumstances; for under normal conditions they are, when rubbed off by the lens in the act of extraction, never regenerated - and the same applies to Pigment cells overlying the Ciliary Body, when in the formation of an Iridectomy, the whole of the Iris superiorly is pulled out from

its attachment leaving the Anterior part of the Ciliary Body bare. Where, however, inflammation or increase of tension has supervened, upon an operation, there is always a marked growth of the Posterior Pigment Cells, which in the former case is always irregular; the pigment cells proliferating after no regular manner as is well-known, while on the other hand the consequence of the increased tension of Glaucoma on the Pigment Layers would appear also to have a stimulating effect on the cells but then this growth is a regular one not tending to form masses but spreading along the Iris surfaces giving rise to clinically what is known as Ectropion of the Pigment Layers.

This regular growth of the Posterior Pigment in consequence of the stimulation of Increased Tension in the eye is well seen in Cases XXXII. and XXXIII. where the Pigment has grown backwards along the surface of the Zonular Fibres.

### The Capsule.

It hardly comes within the province of a histological study such as this, to consider the various theoretical advantages of the different methods of opening the capsule whether by the cystotome or capsule forceps, latter are now always used by Prof. Fuchs.

The splendid optical results that may be obtained by the use of Capsule Forceps are well shown in the series of cases; the consequence of the removal of a central piece of Lens Capsule is that the chance of Secondary Cataract developing subsequently is very much diminished, as the source, i.e., the Anterior Capsule with its epithelium, from which this opacity develops is removed.

The gap, made by the Forceps varies in shape and size depending on whether an Iridectomy has or has not been made.

Owing to the relaxed condition of the Lens Capsule after the extraction of the Lens, measurements made to ascertain the size of the rent formed by the forceps have no absolute value, as one is compelled to measure the chord instead of the arc of the segment of the circle, which the capsule presents. For practical purposes this difference can be disregarded. Such measurements show that in the horizontal

direction the capsular rent measures about 3 mm. In the vertical meridian the gap is bigger, depending however on whether an Iridectomy has or has not been made, for in the former case owing to their being much more room a much larger piece is removed varying from 3.7 mm. to almost double that - the largest vertical measurement being 7 mm. In simple extraction the size of the piece of the capsule removed is limited by the size of the pupil at time of operation and so in the cases at hand, the vertical measurement varied from 3 to 4.5 mm., so that the gap is more or less circular in shape.

The extraction of the Lens leaves the posterior capsule collapsed and flaccid and the edges of the rent Anterior Capsule rolled out, the most marked example of which is present in Case II. Fig. 2., resulting in the contents of the equatorial part of the capsular Sac being exposed to the Aqueous Fluid. In consequence of the pressure of the vitreous behind and the negative pressure of the Aqueous in front; the Posterior Capsule is pushed forwards so that it occupies a plane considerably anterior to its former position, and in fact bulges into the Anterior Chamber thereby causing the equatorial region to turn or cant forward as in Cases II, II, IV, V.

As the pressure between the Vitreous and Aqueous

Chambers becomes more evenly balanced the Posterior Capsule gets pushed backwards till it lies in a plane which joins the Apices of the Ciliary Processes. Another and possibly more important factor in the drawing back of the Posterior Capsule is the formation of the Crystalline Pearl. This results from the flaccid Posterior Capsule falling upon the remains of the Anterior Capsule, the posterior surface of which if the cataract is not hypermature will still be lined by its Epithelial Layer, which in consequence of the stimulus of the aqueous fluid proliferates to a marked extent forming a mass of spindle capsular cataract cells which firmly unite the adjacent surfaces of the capsule, thereby shutting off the equatorial region of the Lens Capsule from the influence of the aqueous, and so lead to the formation of the Crystalline Pearl. In shape this is at first a flattened, more or less spindle shaped sac lying behind the Iris, with its inner end directed forwards owing to the bulging forward of the Posterior Capsule while its outer end apparently rests on the Ciliary Body, thereby obliterating or diminishing the circumlental space. Cases I., etc.

The contents of the Crystalline Sac vary very much. At first it only contains Cataractous debris adherent to the Capsule along with, if the Cataract

is not absolutely mature, the Capsular Epithelium.

In the course of time the Capsular Epithelium begins to proliferate and form new lens fibres which are normal in form and in appearance and exactly similar to those of the lens which they try to replace. On the other hand the epithelial cells may not be able to form perfect fibres but only form large vacuolated cells, owing possibly to the surroundings not being favourable enough for the production of perfect fibres.

These new cells surround the remains left behind and enclosed in the sac, with the result that the sac which previously was flat, becomes in consequence of its contents being increased, spherical in outline. This alone brings out in marked contrast those cases examined a short time after operation and those in which extraction has been performed some years previously. The Crystalline Pearl is closed as mentioned above by the union of the two surfaces of the Capsule by the connective tissue like growth of the Capsular Epithelium. Now this where it comes in contact with the thinner Posterior Capsule causes crinkling of the same, at the point of contact, Case XIV., etc., in consequence of which the Posterior Capsule, which previously ran in a flaccid manner from one side to the other, and curved forward by the

pressure of the Vitreous behind, now becomes stretched and pulled taut and the circumlental space for the same reason becomes increased. Cases XXIX., etc.

## CASE I.

### Three days old.

History. The Case died three days after Extraction with Iridectomy had been performed.

A study of Fig. 2, 3 and 4 shows well the changes in position, direction, and plane of the incision that have been made in this case, for the first part of the section, - Puncture and Counter-puncture come out in the Limbus, after an oblique course while finally the knife has been brought out perpendicularly to the surface just internal to the inner margin of the Limbus.

These figures also show that the least displacement and best adaptation of the surfaces are to be found the further one gets from the centre of the Incision.

In Fig. 2, in consequence of the gaping of the wound the conjunctival and corneal epithelium have grown right down the respective margins of the wound and are proceeding to spread along the posterior surface of the cornea, - the first stage in the production of an Anterior Chamber Cyst. Fig. 2. also shows Descemet's membrane broken and the Epithelium growing in front of it.

In Fig. 3. the surfaces of the wound are covered by Fibrinous Exudate, while owing to the apposition of the outer margins the surface Epithelium has not been able to penetrate further than the outer margin of the incision.

In Fig. 4. there is a small and oedematous Limbal Flap which completely prevents the Epithelium growing down into the wound, the surfaces of which are united by Fibrin.

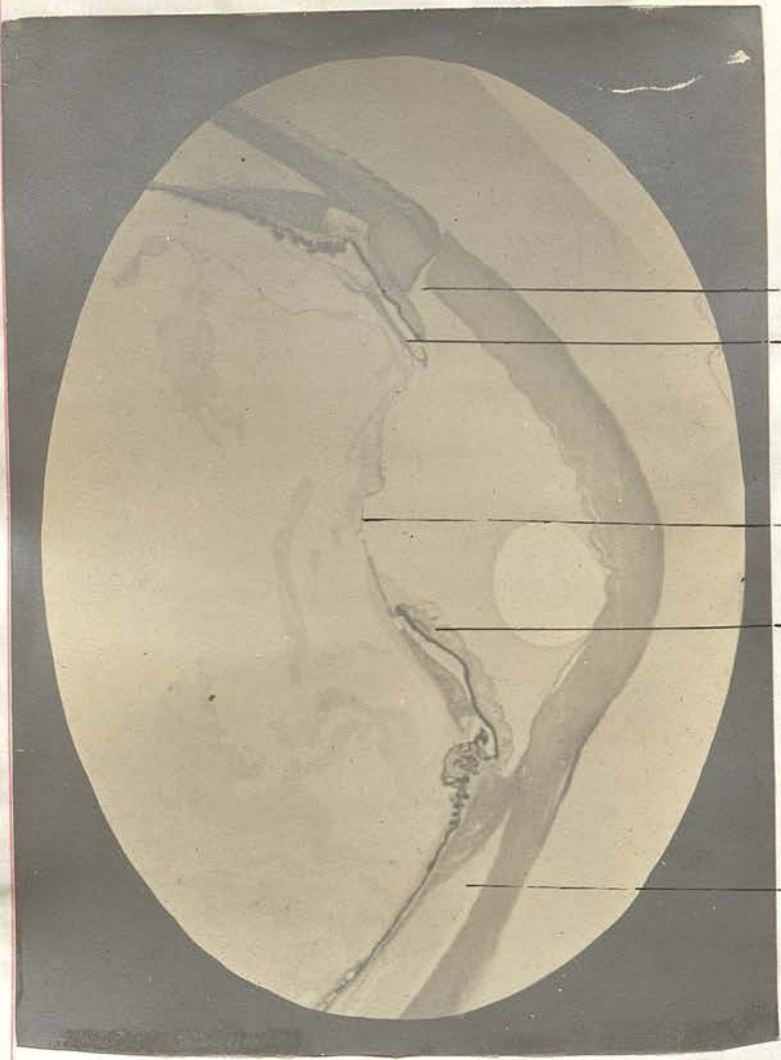
This case shows well therefore the advantages of an Incision lying in the limbus where even if the lips do gape yet the conjunctival flap by its early apposition will close the wound from all external and injurious influences.

Owing to the way the Sphincter has been sectioned, Fig. 1., which is taken from the Centre of the Incision goes through the Internal Pillar of the Coloboma, which Fig. 4. shows the Iris Stump proper. Slight extravasation is present in front of the Sphincter Iridis.

There is a gap in the Anterior Lens Capsule of 4.4 mm. removed by the capsule forceps, while the Posterior Capsule extends in a flaccid and unbroken line from one side to the other.

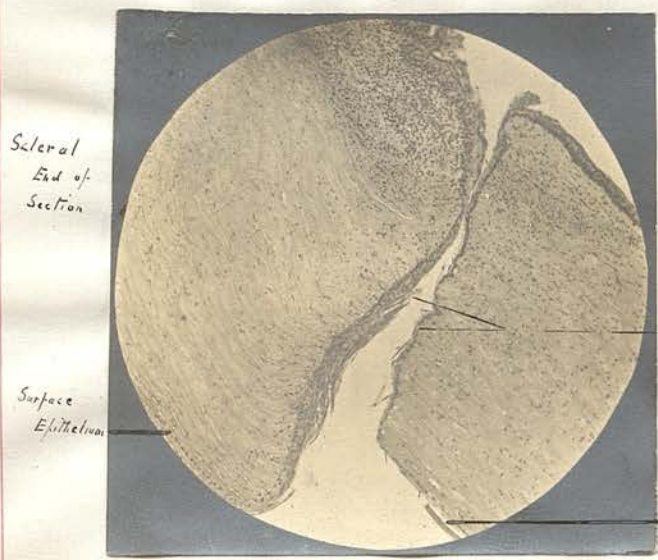
The Choroid both above and below is detached, the space between the Ciliary body and Sclera being filled by Albuminous Material.

CASE I.



Incision, seen in Fig. II.  
 Flattened & spindle shaped  
 Superior Capsular Sac.  
 Post Lens Capsule.  
 Extravasation present  
 in front of Sphincter.  
 Detached Choroid  
 since filled with  
 Opaque fluid  
 The same Superiorly.

Fig. I



Scleral  
 End of  
 Section  
 Surface  
 Epithelium

Limbus

Epithelial Downgrowth.

Descemet's Membrane  
 with Epithelium growing in front of it.

Fig. II

Limbus Flap



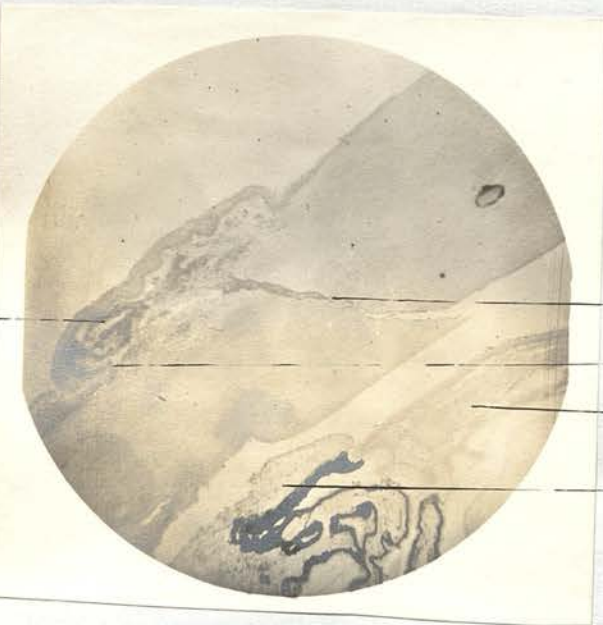
Corneal End of Section.

Epithelial Plug.

Fibrin Deposit.  
covering the wound.

Fig. III.

Extravasated Blood



Fibrin uniting Lips.

Extent of Epithelial Downgrowth.

Supr. Capsular Sac  
resting on Ciliary Body.

Iris Stump.

Fig. IV

CASE II.

Three days.

History. The Patient died three days after Extraction with Iridectomy.

The Incision runs obliquely and comes out at the inner margin of the Limbus, just like the preceding case; here however there has not been the same gaping, though there is much more marked overlapping of the Scleral Lip by the Corneal. This Inferior Lip is swollen and measurements of it show that it is thicker than the superior by .24 mm.

The difference in the two figures in the way the Incision runs, as also in the length of Descemet's Membrane on the Scleral side is very marked, although both are taken from sections going through the Coloboma. The obliquity with which Descemet's membrane has been severed is well shown.

The Iris Stump is .93 mm. long. It presents a rent towards its root into the Angle of the Anterior Chamber, while Posteriorly the pigment layers have been detached accompanied by a break in the continuity of the Dilator. As might be expected there is extravasated blood in the anterior and adjoining part of the Ciliary Region, but none present in and about the Sphincter Iridis of the Iris below.

Schlemm's canal on both sides contains Red Blood Corpuscles and Pigment Granules which are to be seen making their way through Fontana's Spaces.

CASE II.

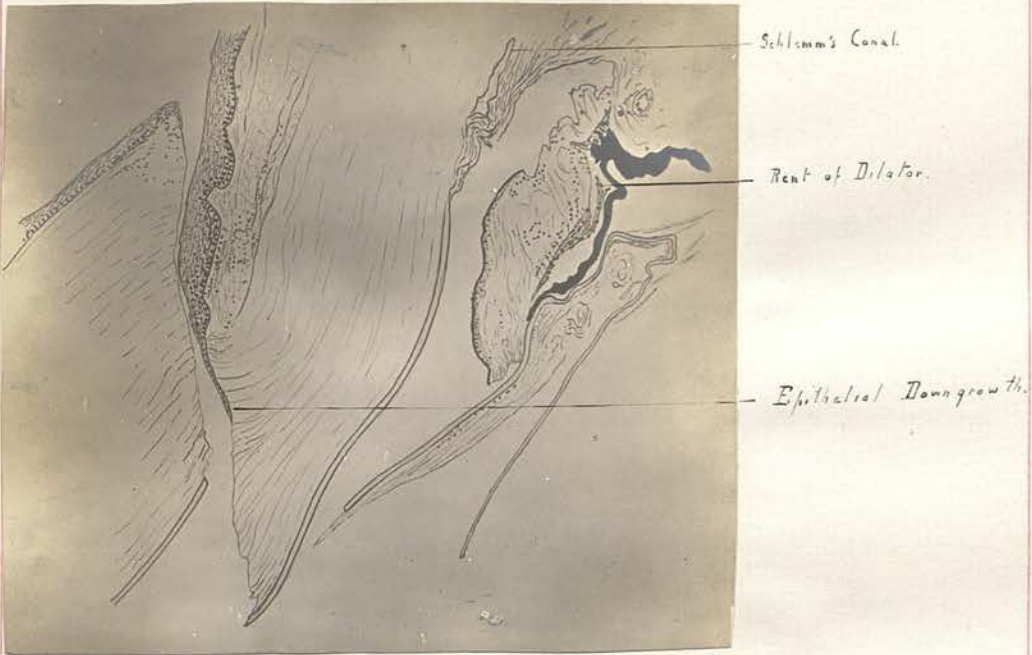


Fig. I.



Fig. II.

## CASE III.

Three days.

Also a case three days after extraction.

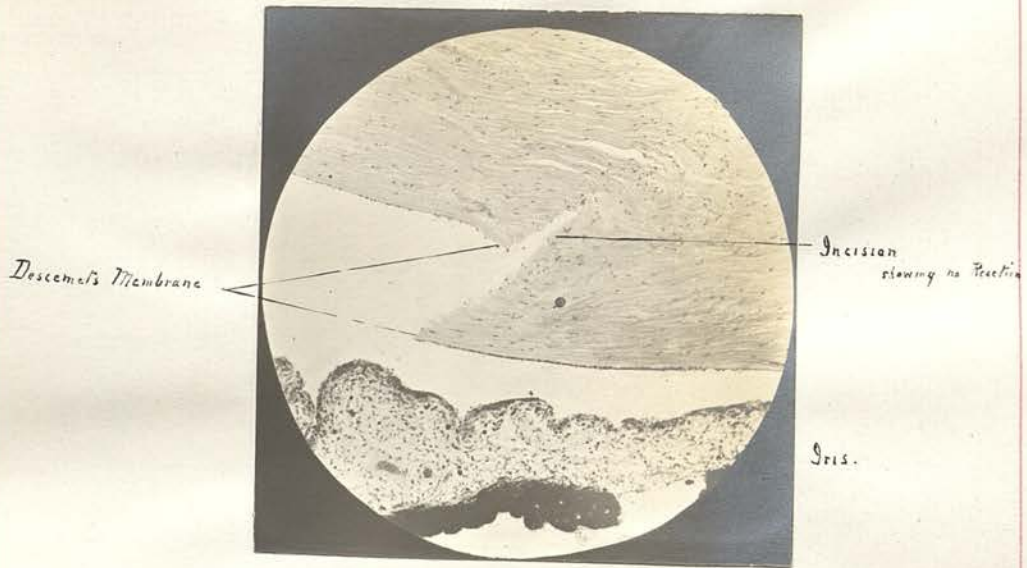
Fig. 1. is a Horizontal Section of extreme outer end of Incision, - the Puncture - which is not complete in the section.

The Corneal Fibres show no regenerative activity whatever, while their severed ends are somewhat swollen and have indistinct margins.

Descemet's Membrane is cut here in a line with the Corneal Fibres, as is always the case at Puncture and Counter-puncture, so differing from sections going through the Coloboma as in Fig. II. of the Preceding Case.

Fig. 2. shows detachment of the Choroid present in this case.

CASE III.



*Fig I*  
*Horizontal Section.*



*Fig. II*

CASE IV.

Six Days.

History In making the Section the knife becoming entangled in the Iris, resulting in the latter becoming so firmly adherent to the surface of the wound that it could not be replaced.

Next day the Anterior Chamber was re-established.

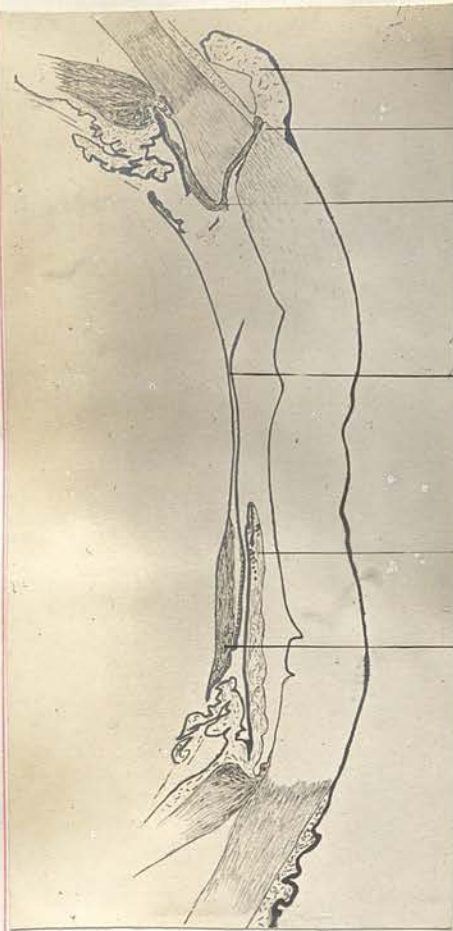
Patient died six days after from Embolism of the Pulmonary Artery.

Fig. 1. The conjunctival flap is oedematous, and shows very few cells and these have nuclei which are pale and indistinct. Prolapsed Iris fills the space between the lips, it is thin and pulled upon and its pigment layer is absent except towards the Root. The Angle of the Anterior Chamber superiorly is open.

In Fig. 2. is seen the outer margin of the Corneal wound, showing Pigment granules entering between the Corneal Fibres.

In front of the Sphincter Iridis some extravasation can be seen. The Posterior Capsule is intact and bulging forward into the Anterior Chamber.

CASE IV.



- Gelatinous Capsular Flap.
- Point from which Fig 2 is taken.
- Prolapsed Iris.
- Posterior Capsule bulging forward.
- Extension inferior & to outer border of Sphincter
- Spindle shaped Crystalline Pearl resting on Ciliary Body.

Fig. I



- Pigment Granules making their way between Corneal Fibres.
- Cornea.
- Prolapsed Iris.

Fig. II.

CASE V.

Seven Days.

History. R. S., aet 83, was operated on by Prof. Fuchs on the 25th Sept. 1895. On the day following the operation the Anterior Chamber was reformed.

The Patient died on the 2nd Oct. in consequence of a Pneumonia supervening, on which date the Eye was somewhat injected. The Cornea showed at its upper margin a little traumatic opacity surrounding a vascularised cicatrix. The Coloboma which was 5 mm. broad, had both Pillars in position, behind which, at the periphery, lay some cataractous lens matter.

Fig. 1. The Incision runs pretty vertically to the surface and comes out in the Limbus. The lips of the wound are very well opposed, there being no overlapping. The gaping internally is artificial and due to shrinking.

The Limbal Tissue superiorly is more voluminous than it is inferiorly, though one can not say that it is oedematous.

Between the lips and growing down from the Limbus is a down-growth of Connective Tissue, the cells of which run in a direction parallel to the wound and therefore at right angles to the direction

of the corneal fibres. (Fig. 2.) This Intercalary Mass is accompanied by Capillary Vessels derived also from the Limbus.

Measurements show that the lip wounds are appreciably swollen, in consequence of the adjoining inter-lamellar spaces being filled by albuminous matter, possibly derived from imbibition of Aqueous or lymphatics of the Cornea, thus giving rise to the opacity in the upper part of the Cornea present at the time of death.

The Corneal Parenchyma shows no reaction.

Descemet's Membrane is wanting for some distance at both margins of the Incision, the Endothelium has however started to grow along the exposed corneal fibres to cover this deficit.

The Stump of the Iris, which is directed somewhat backwards is considerably damaged, the Pigment Layers being in great part detached, and the Dilator torn, while small extravasations are present in the substance of the Iris tissue itself.

The Stump however shows no reaction or reparative processes of any kind, its cut surface especially showing no changes.

The Iris inferiorly likewise shows no reaction although it shows signs of trauma following from the Iridectomy, for the Sphincter Iridis (Fig. 3.) is displaced and pulled out of its bed, towards the

Pupillary Margin, leaving an empty space at its outer or ciliary end, which contains extravasated Red Blood Corpuscles. At the Root of the Iris, and adjoining Ciliary Region, minute extravasations are likewise present, pointing to a wrench sustained by this part. Between these two extremes, the intervening Iris shows no signs of trauma.

There is, in the Supra-Choroidal Space Superiorly, some Albuminous Fluid the sign of a detachment of the Choroid.

The Equator of the Lens Capsule rests both above and below on the Ciliary Body, while the Posterior Capsule extends between the two, with slight convexity forward. The Anterior Lens Capsule has had a piece 5.6mm. measured vertically, removed by the Capsule Forceps.

In the Superior Capsular Pouch is a mass of breaking-down lens matter, which prevents the two layers of Lens capsule from closing on each other, and forming the secondary cataract mentioned in the history.

The Capsular Epithelium lining the equatorial region here has the normal character of the Epithelium, i.e., it is cubical in form, but as it approaches the free end of the Anterior Capsule the cells become flatter and more spindle shaped and at

its broken end (Fig. 4.) they turn round upon its Anterior Surface and form a mass of spindle shaped cells, several layers thick, the whole being surrounded by Lens matter in various stages of degeneration.

In conclusion it must be stated that the optical results attained by the operation in this case have been excellent.

CASE V.

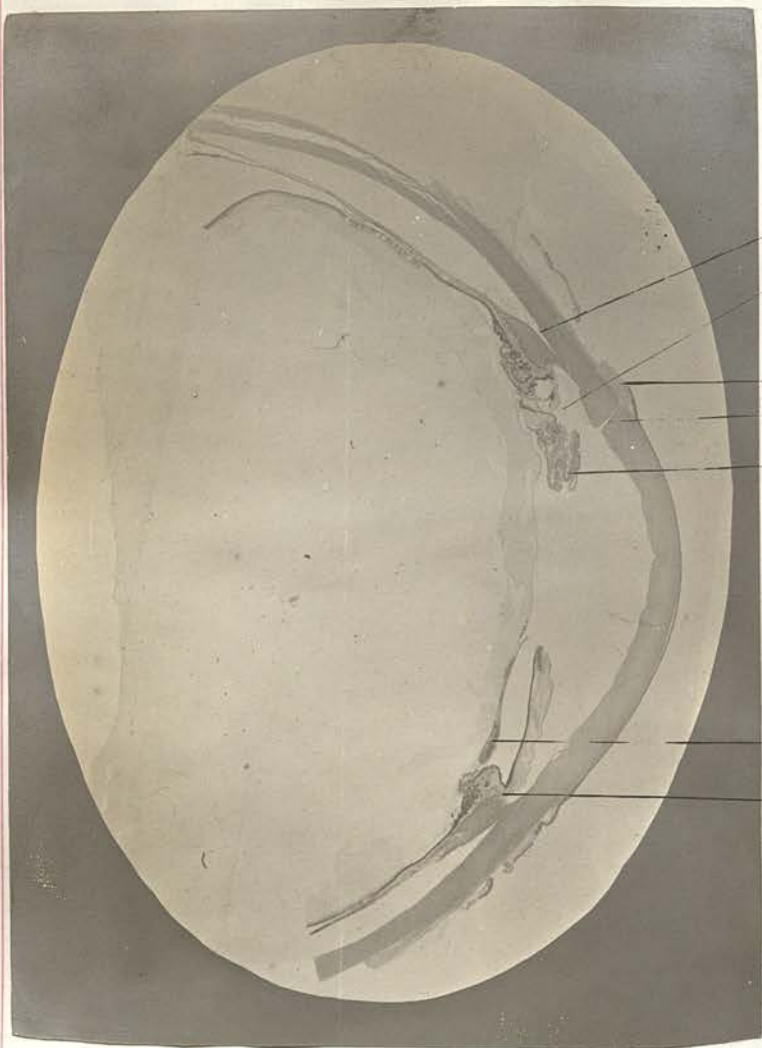


Fig. I



Fig. II

Sphincter Iridis  
pulled out of its position.

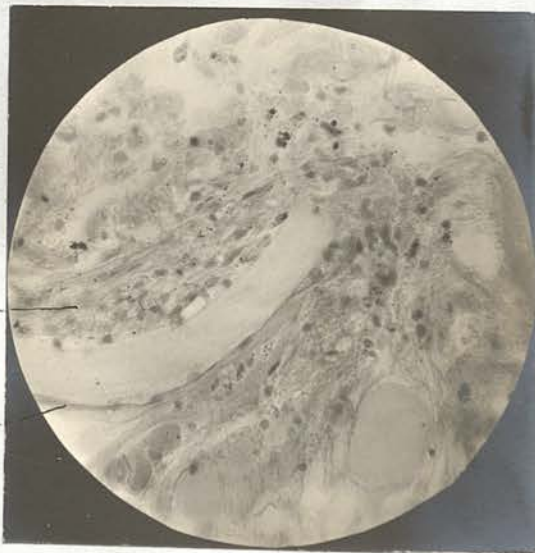


Red Blood Corpuscles  
in empty space.

Fig. III.

Proliferation of Capsular  
Epithelium on Anterior  
Surface of Capsule

Modified Capsular  
Epithelium.



Degenerated Lens Fibres.

Fig. IV.

CASE VI.

Seven Days.

History. D. A. aged 63, died from Pulmonary Embrolium, 7 days after extraction c̄ Iridectomy.

The Anterior Chamber was reformed on the day following the operation.

Unfortunately owing to Post-mortem handling the Posterior Capsule has been ruptured and the Wound burst open.

This case presents exactly similar features to the preceding case, for in position the incision here is very like the last, though its direction is much more oblique and so in consequence one finds that Descemet's Membrane protrudes beyond the margin of the Scleral Lip. The healing too has reached the same stage and by the same process, i.e. an Intercalary Mass growing down from the Limbal Tissue, which however has been pushed out of the wound and lies attached to the Conjunctival Flap, leaving only the inner half of the downgrowth attached to the two surfaces of the Incision.

One cannot but be struck by the good apposition in which the two lips lie in relation to each other, in spite of the bursting of the wound, and speculate what part the inherent rigidity of the senile cornea may have in maintaining such apposition.

The Lips of the Incision are swollen.

The Iris Stump is very small only .35 mm., and shows similar signs of trauma as is present in Case V.

There is likewise here Detachment of the Choroid both above and below.

CASE VI.



CASE VII.

Eight Days.

History. F. H. died 8 days after Extraction had been performed after Graefe's Method.

The day following the operation the Anterior Chamber which had reformed contained blood.

Fig. I. Unlike the typical Graefe Incision the wound runs here obliquely through the Sclera, and so aiding, if not accounting for the overlapping of the Corneal Flap. The Section is very peripheral and just misses going through Fontana's Spaces and Schlemm's Canal.

The track of the wound through the sub-conjunctival Tissue, which is somewhat oedematous - is marked out by extravasated blood. Between the lips of the wound and extending half-way down the Scleral edge of the same, is seen Connective Tissue which has grown down from the Upper part of the Episcleral Tissue. This mass whose cells lie in a vertical direction contains new formed blood vessels - Fig.II.

Descemet's Membrane is, like the section through the Sclera cut obliquely, while the Posterior Endothelium can be seen creeping round the inner margins of the wound especially the inferior.

Fontana's Spaces are filled with Red Blood Corpuscles and so is Schlemm's Canal, though there are

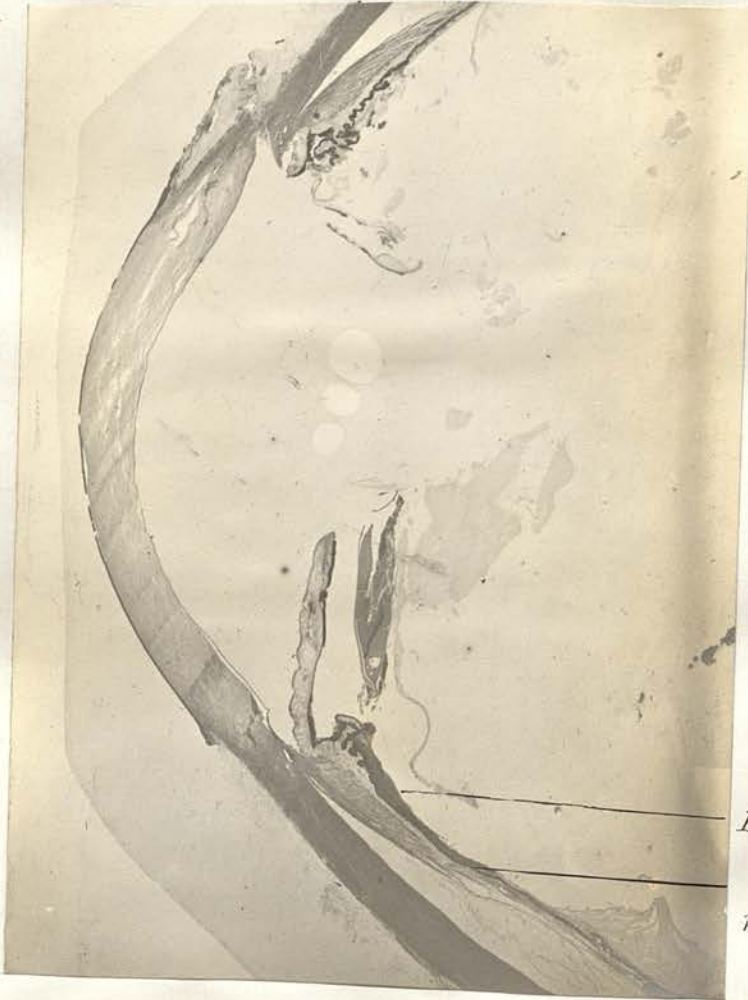
none in the Anterior Chamber proper. The Iris Stump at its root shows a rent of the Dilator.

Both the Anterior and Posterior Lens Capsules are absent. The Zonular Fibres especially inferiorly have been damaged so permitting blood to gravitate back between its layers, which it does as far back as the Ora Scerata. But further, the wrench which these fibres have received has resulted in their pulling on the Pars Ciliaris Retinae from which they arise, with the result as seen in Fig. III., that this has been broken across at one part and the Extravasated Blood, gravitating backwards comes to lie in and behind the rent.

CASE VII.

Swollen Limbus.

Injection



Extravasated  
Blood

Rent in  
Pars Ciliaris. Fig. 77.

Fig. I.

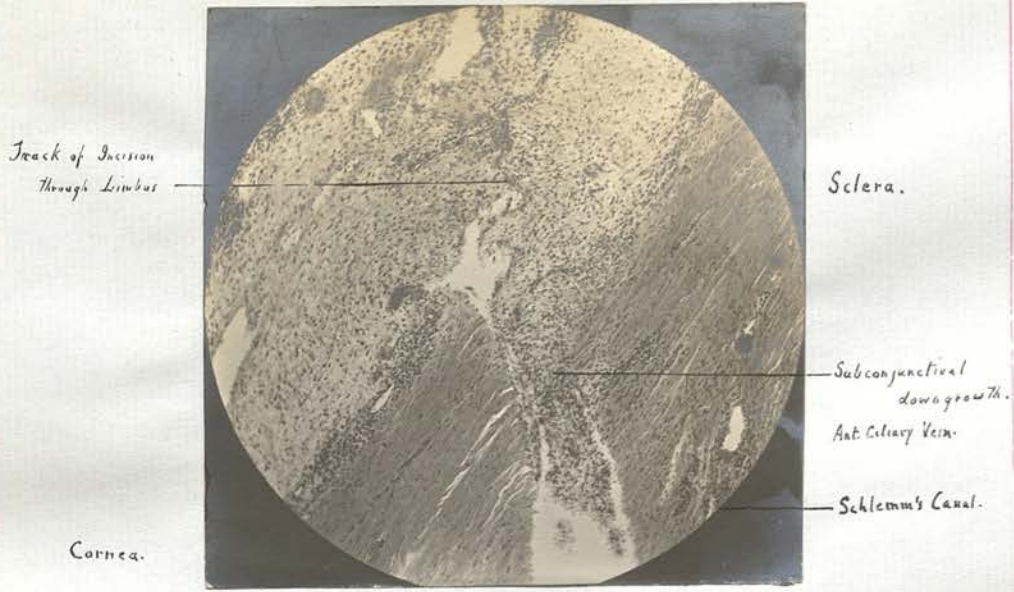


Fig. II



Fig. III

CASE VIII.

Eleven Days.

History. J. K. aet. 66 was operated on 6th March 1896 and died 11 days after.

The Pillars of the Coloboma were caught in the wound and Fig. I. illustrates a section going through the Prolapsed Iris.

The Limbal Tissue is completely united over the Incision and the Epithelium runs unbroken over it with a small indimpling however where the section has come out on the surface.

The Lips of the wound are not swollen though they are separated and the Inferior lip pushed forward by the prolapse, which so fills up the gap that there is no room for any sub-conjunctival downgrowth. The Ciliary Body is pulled forward by the prolapse but the Superior Angle of the Anterior Chamber is quite open and free.

There is some extravasated blood in the root of the Iris.

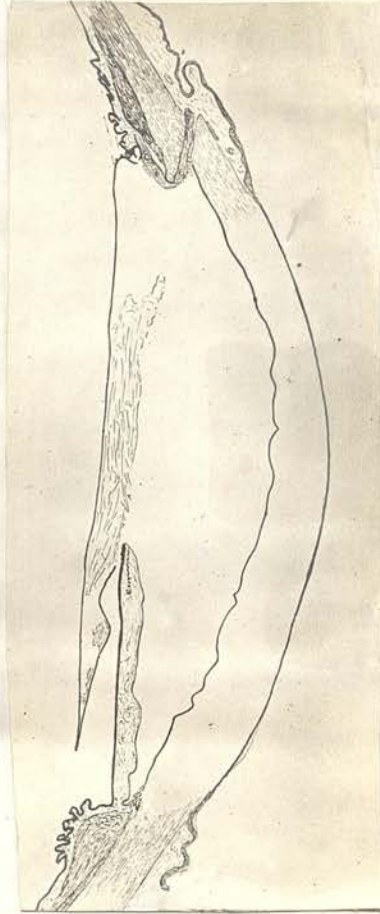
The Anterior Lens Capsule has been removed superiorly right up to the Equator, while the Posterior is intact, and has in front of it lenticular remains.

CASE VIII.

*Equator of Capsule.*

*Incision  
with Prolapsed Iris.*

*Lens Debris.*



*Fig. I*

CASE IX.

Twelve Days.

The Patient died 12 days after Extraction cum Iridectomy.

Fig. I. shows that the knife at the centre of the Coloboma came out just internal to the Limbus. There has been slight gaping and springing forward of the Corneal flap, and in consequence the surface epithelium has been able to grow down both surfaces of the incision. In the case of the scleral surface this has been accompanied by a downgrowth of the limbal tissue which has penetrated three-quarters of the way down.

A "tag" of Descemet's Membrane on the upper margin is well seen. This is not present in microscopic sections cut nearer either extremity of the wound - showing as we have said before that this tag must result from the way the knife is brought out. The Pectinate Ligament shows a tear extending from the Angle of the Anterior Chamber to the Supra-Choroidal Space, resulting from the pull the part has received in the performance of the Iridectomy. Albuminoid matter fills this space.

CASE IX.

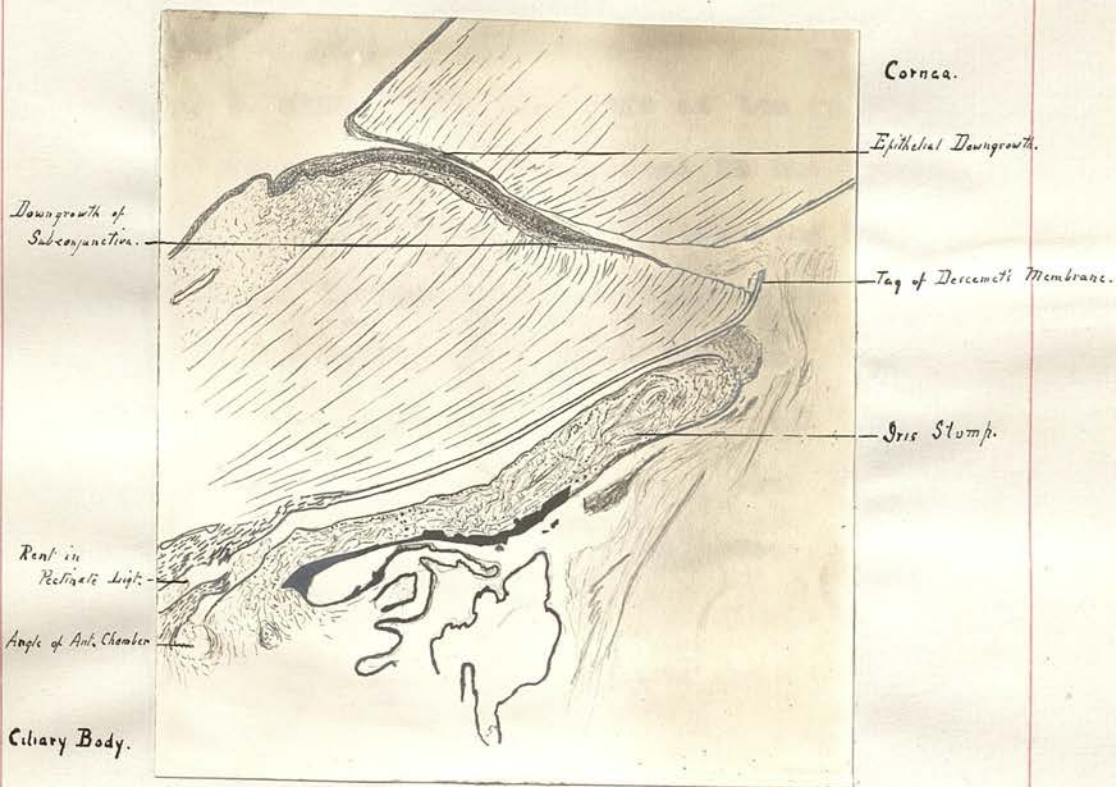


Fig. I.

Thirteen Days.

History. Patient aged 72, died on 8th November 1893, 13 days after Simple extraction had been performed.

In position the incision lies very much like the last case just internal to the Limbus.

The Surface Epithelium which has grown down both lips forms at the deeper part a solid mass, resting on a fibrinous exudate, which is lined, towards the surface of the Anterior Chamber by an ingrowth of Endothelium, which joins the two cut ends of Descemet's Membrane and so cuts off the wounds from the anterior chamber. Fig II.

The downgrowth of surface epithelium lies directly on the cut corneal fibres except in the case of the upper lip where as in the previous case the limbal tissue has also grown down into the wound and shows considerable reaction.

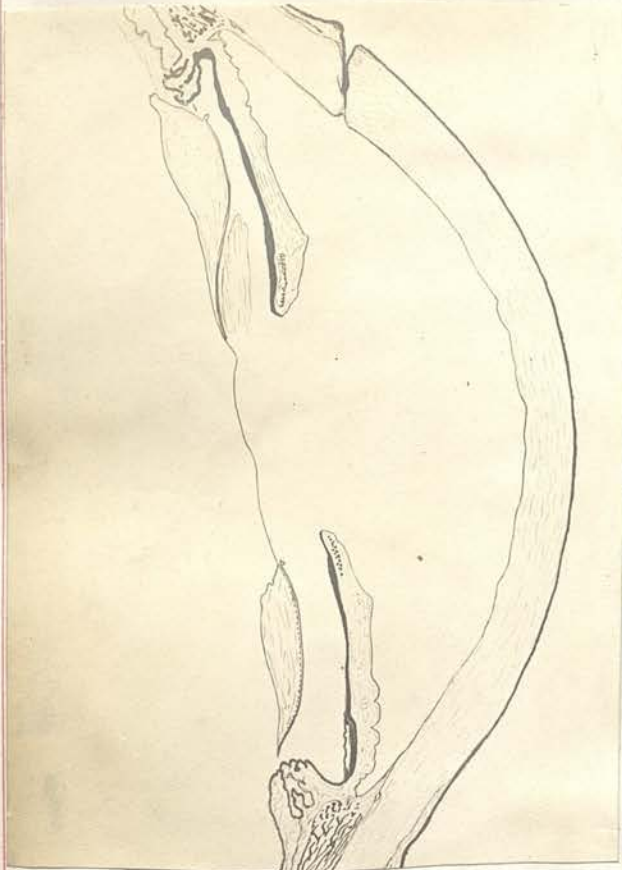
At the centre of the upper lip there is a false incision making a diverticulum.

The inferior lip wound is swollen so that it projects beyond the superior or scleral surface both on its anterior and posterior aspect.

The Iris lies perfectly free and on one plane with no signs whatever of reaction.

A piece of the Anterior Lens Capsule corresponding to the pupillary space has been removed. by the Capsular Forceps, while behind the Iris lie the Capsular Sacs joined by the Posterior Capsule which runs in a line joining the summits of the ciliary Bodies together.

CASE X.

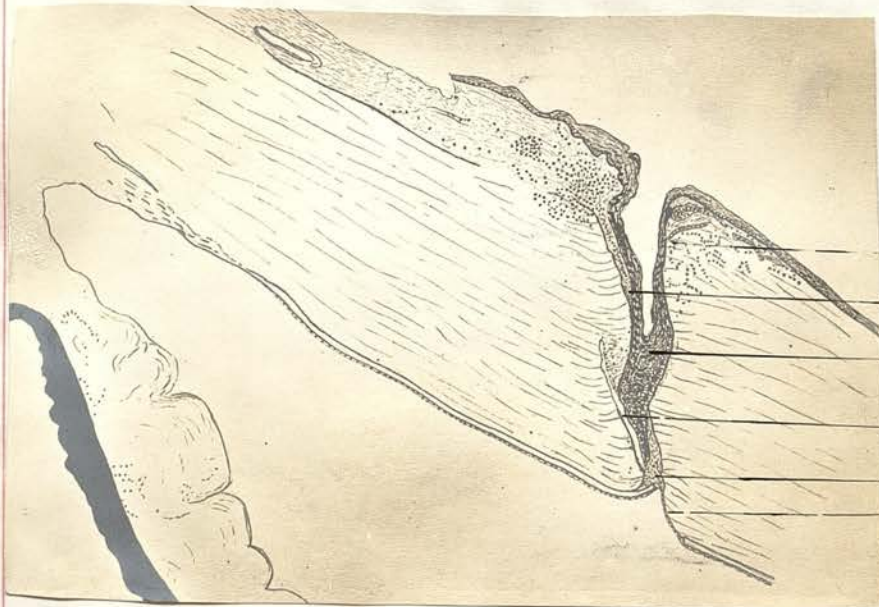


*Incision.*

*Lenticular Remains behind Iris.*

*Inferior Capsular Sac.*

*Fig. I*



*New Vessels.*

*Subconjunctival Downgrowth.*

*Epithelial Plug.*

*False Incision.*

*Fibrin.*

*Endothelium covering inner end of Incision*

*Fig. II*

CASE XI.

Fourteen Days.

The Incision lies just internal to the Limbus and between its lips lies the whole of the Posterior Lens Capsule which, owing to the Zonular Fibres giving way at the sides and inferiorly, has prolapsed and lies bound down by Connective Tissue folded and curled up between the lips forming a firm Plug. Its superior equatorial region is, however, still maintained in position.

Both lips are swollen, the inferior one in particular, while the superior lip margin shows a small diverticulum caused by the knife making a false incision.

The surface Epithelium has grown inwards down both margins on either side of the Prolapsed Capsule. In the case of the scleral surface the Epithelium has penetrated only as far down as the middle of the lip, though on the corneal side it has grown down much further.

The Iris stump is very small only .68 mm. and shows marks of considerable trauma, for its Anterior Limiting Membrane is missing, while posteriorly the Dilator Pupillae with the Pigment Layers are absent, so that the Iris Stump practically consists of a small tag of Iris tissue divested of its

anterior and posterior layers, though showing no signs of reaction. The root of the Iris inferiorly (Fig. II.) also shows signs of traumatism, for at its attachment to the Ciliary Body, the Iris presents a rent towards the angle of the Anterior Chamber, with extravasation of Blood at the Iris Root and adjoining part of the Ciliary Region.

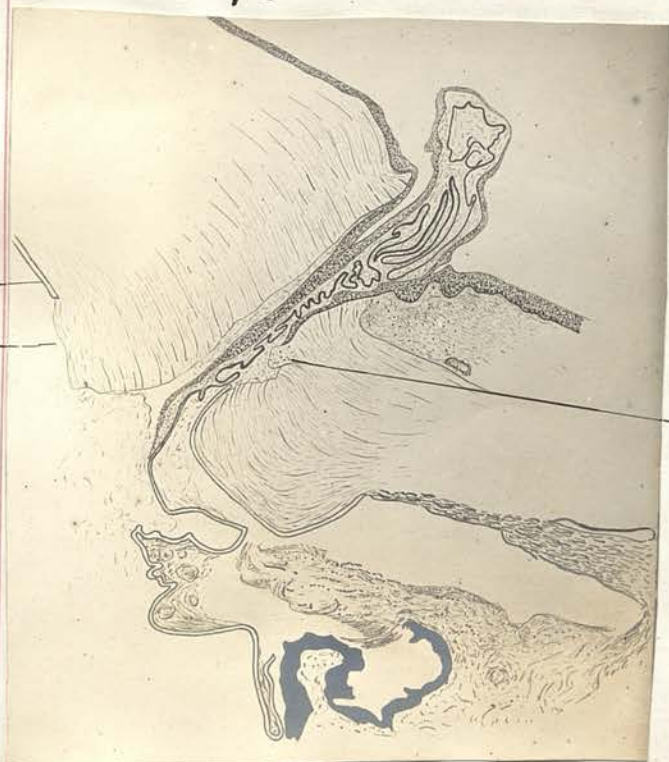
CASE XI.



Incision

Extravasation at Inf. Iris Root.

Fig I



Prolapsed Lens Capsule  
with Epithelial downgrowth  
on both sides.

Limbus

False Incision.

Schlemm's Canal.

Iris Stump devoid of Dilator  
& pigment layers.

Ciliary Body.

Fig II

Fig III



Pectinate Ligament

Ciliary Body

Iris Root Junction

CASE XII.

Fifteen Days.

History. The Patient died 15 days after Extraction  $\bar{c}$  Iridectomy.

The two surfaces of the Incision lie in very good apposition, though unfortunately the microscopic section from which Fig. 1 and 2 have been taken has been damaged at the centre of the incision in sectioning.

Throughout the inner half of the incision the two lips are in indirect contact, but at the outer half there is a very small gap of only .01 mm. and this space has been filled up by a downgrowth of Cells derived from the Subconjunctival Tissue, whose direction, as is the rule in such early cases, is parallel to the wound surfaces.

The scleral tissue shows no increased number of nuclei and no regenerative activity.

The Iris Stump ends opposite the inner margin of the Incision and is .9 mm. long. Fig. II.

At its cut extremity extravasated blood can be seen, with no signs, however, of reactionary changes.

At the Angle of the Anterior Chamber there is a slight tear or rent of the Ciliary Body and this is associated with a much more extensive rupture of the

Ciliary Body from its attachment, accompanied by a detachment of the same from the Sclera, while the Supra-choroidal Space both here and Inferiorly is filled with a quantity of Albuminous Fluid. The Posterior Capsule is intact and the Capsular Sacs are closed and rest, as is the rule, on the Ciliary Body.

CASE XII.

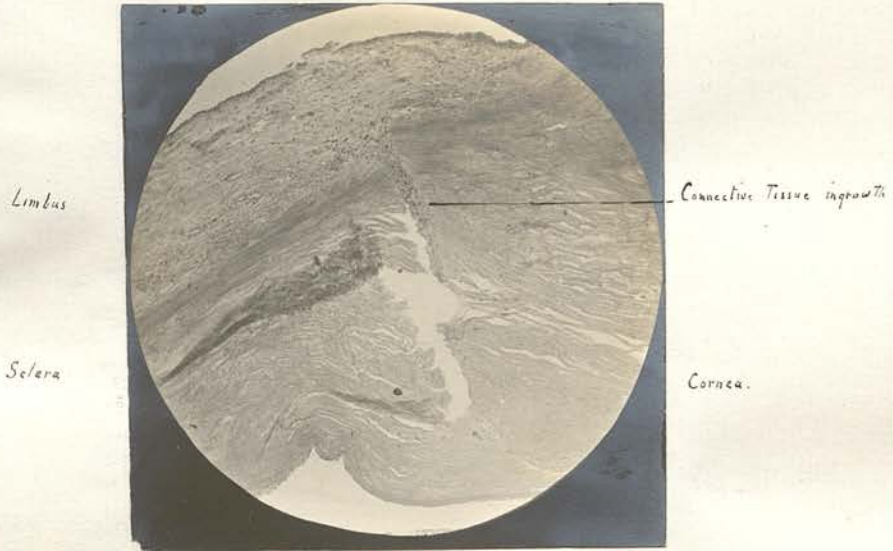


Fig I



Fig. II

CASE XIII.

Sixteen Days.

History. Patient died 16 days after Simple Extraction.

The Incision does not run in one place, but in a more or less step-like manner.

There is a considerable gap between the two lips owing to a slight adhesion of the Iris to the inner margin of the wound, thereby causing the scleral flap to be pulled in somewhat.

This gap between the two surfaces which measures .14 mm., is filled by a downgrowth of Subconjunctival Tissue.

The Angle of the anterior chamber superiorly is quite free and open. The Posterior Lens Capsule lies in the usual forward position extending in an unbroken line from one ciliary body to the other.

The Equatorial Capsular Sacs are empty.

CASE XIII.

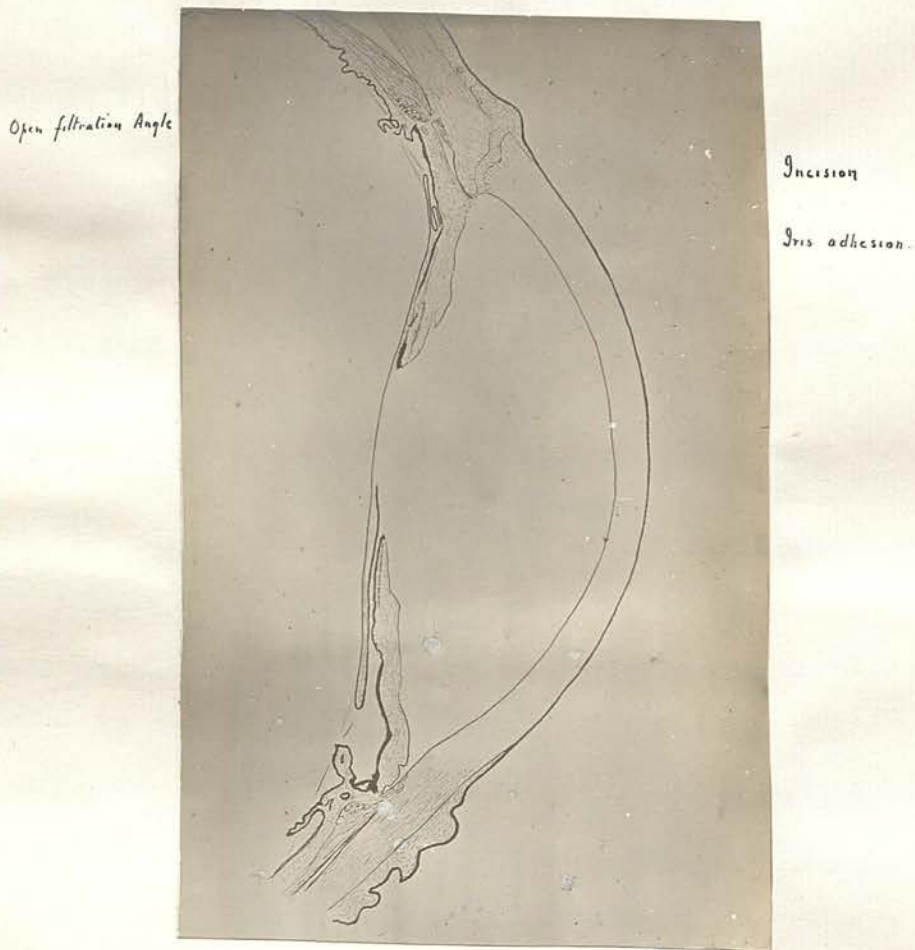


Fig. I.

## CASE XIV.

Twenty Days.

History. Joseph H., aet 69, died twenty days after Peripheral Linear Extraction had been performed (on Right Eye.)

At time of death the wound appeared soundly and well healed, the Conjunctival Flap being however a little swollen.

At both extremities of the Incision but especially at the inner, dark pigmented Masses were visible, covered over by the Conjunctiva and formed by the pillars of the Coloboma which had prolapsed thereby causing the pupil to be pulled up. Hardly any Secondary Cataract visible but traces of blood were to be made out in the Anterior Chamber. The Collapse of the Cornea is a post mortem change.

Fig. I. is from a section going vertically through the centre of the Coloboma, in which the incision is very peripheral and runs very perpendicularly to the surface.

The Conjunctiva shows on its surface an indimpling where the incision has ended. The subconjunctival Tissue shows a marked increase of new formed vessels and cells.

The Anterior Lens Capsule is prolapsed and lies

in the Subconjunctival Tissue and between the lips of the wound. On both its surfaces and between it and the cut scleral lamellae, the subconjunctival tissue has grown down and into the Anterior Chamber. Fig. II.

On the superior surface of the Prolapsed Capsule this Connective Tissue downgrowth had extended on to the small remnant of the Iris Stump and has filled up the whole space of the superior Angle of the Anterior Chamber, while on the inferior surface of the Capsule it has grown back and become attached to the Posterior Capsule thereby pulling it forward towards the wound. In this mass of Connective Tissue blood vessels can be seen, which have crept in with the ingrowth of the connective tissue down the wound track.

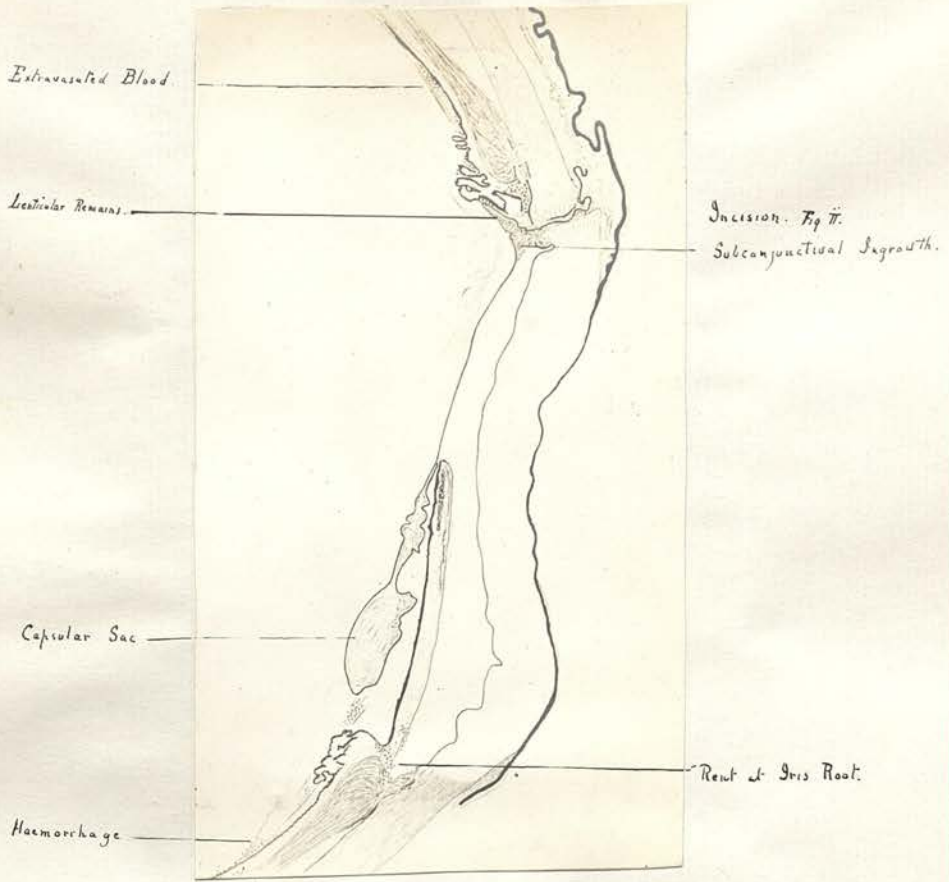
The equator of the lens capsule superiorly is lined by the usual layer of Capsular Epithelium, the cells of which as they are traced forward become more spindle shaped and more like connective tissue cells so that finally a point is reached where all differences between the cells derived from two such different sources cease and it is impossible to say where the one kind of cells begins and the other ends.

The Zonular Fibres have been damaged somewhat

as is shown by the number of Red blood corpuscles which have gravitated backwards both above and below, and lie in the posterior part of the Ciliary Body. The Iris has also suffered from Traumatism as instanced by the extravasation at its root, and adjoining part of Ciliary Region.

The Angle of the Anterior Chamber superiorly as has been mentioned is filled by the connective tissue downgrowth which by contracting will obliterate the filtration angle. This is certainly a possible cause of Post Operative Glaucoma, for if this connective tissue in the Anterior Chamber under any abnormal stimulus it may receive still continues to grow, it will certainly fill more of this important angle than is compatible with the normal excretion of the Aqueous and Increase of tension result.

CASE XIV.



*Fig. I*



*Fig. II.*

## CASE XV.

Twenty-two Days.

History. The patient died on the 27th April 1879, twenty-two days after Graefe's Extraction had been performed in the Right Eye.

The cicatrix measured 10 mm. in length and the Healing process was accomplished without any disturbance. At both ends of the incision dark masses were visible - the internal one of which was the most marked - produced by Prolapsed Pillars of the Coloboma.

There was no bulging of the wound or swelling of the conjunctival Flap.

Fig. I. is from a vertical section going through the centre of the Coloboma.

Comparing this figure with Figs. II. and III., which are taken from sections made towards the outer extremity of the Incision, it will be seen that in a typical Graefe's Section the incision at puncture and counter puncture runs obliquely through the Sclera, while as the knife is brought out, the direction at the centre of the Incision is altered so that it runs perpendicularly to the surface.

At the centre of the Coloboma (Fig. I.) the Incision is .7 mm. from the posterior end of Schlemm's

Canal, while at the inner extremity (Fig. III.) the knife has actually cut through the Pectinate Ligament.

In Fig. I. there is a gap between the two lips of .13 mm., which space is filled by a downgrowth of the subconjunctival or Episcleral tissue, which is attached to the forwardly displaced equator of the lens capsule.

The Iris Stump is very small and completely detached from its attachment to the Ciliary Body, with which it is connected however by a thin strand of pigmented fibres, while its other extremity is associated with the connective tissue downgrowth protruding from the wound.

Fig. II. is from a section going through the Prolapsed Internal Pillar of the Coloboma.

The Anterior Lens Capsule is, at this point prolapsed and incarcerated in the Wound and between it and the inferior lip the subconjunctival tissue has been able to grow down into the Anterior Chamber and, like in the preceding case, become attached to the Posterior Lens Capsule and so pull it forward.

The Angle of the Anterior Chamber is open. The Extent to which the Iris below has been pulled upwards on account of the prolapse is well illustrated.

Fig. III. is taken from the extreme inner end of the incision and shows all the factors present for the making of a Cystoid Cicatrix, for, while the Anterior surface of the Iris is firmly attached to the lips of the Incision, yet their posterior surfaces have no tendency to become adherent to each other, so that if the tension in the Anterior Chamber were to rise, this would be the first part of the Incision to give way and bulge forward.

Owing to the space between the lips being, at this point already filled, the Episcleral Tissue has not been able to grow down into the wound.

The equator of the Lens Capsule is tilted forward towards the Incision, while between it and the Ciliary Body vitreous is protruding, pointing to injury to the Zonular Fibres.

CASE XV.

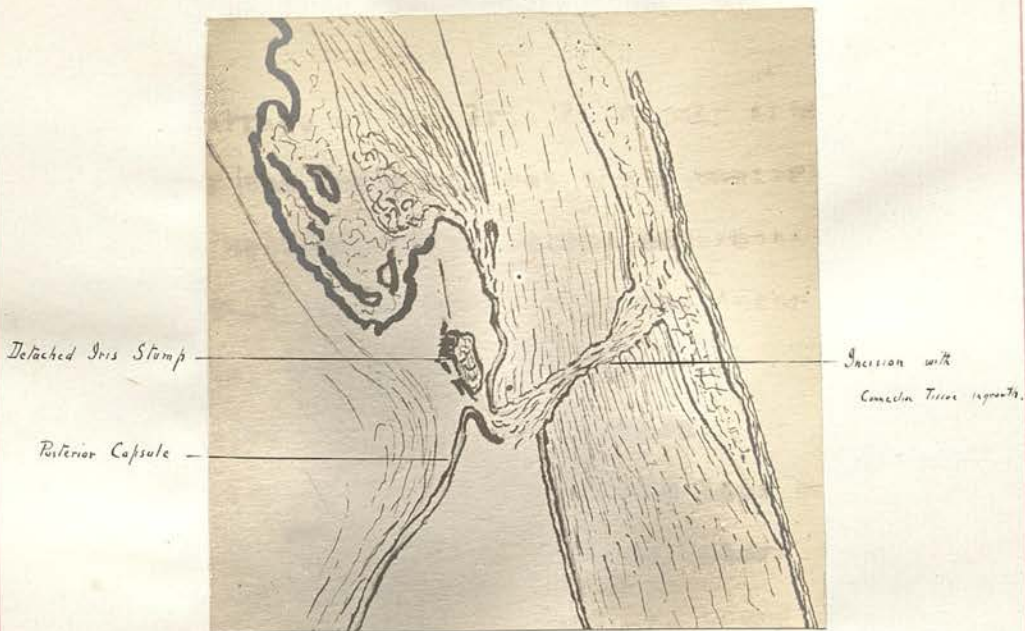


Fig. I.

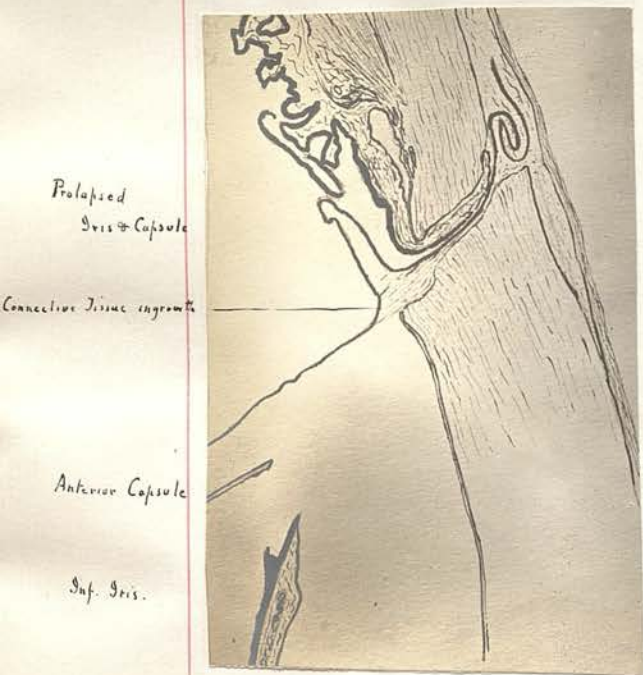


Fig. II

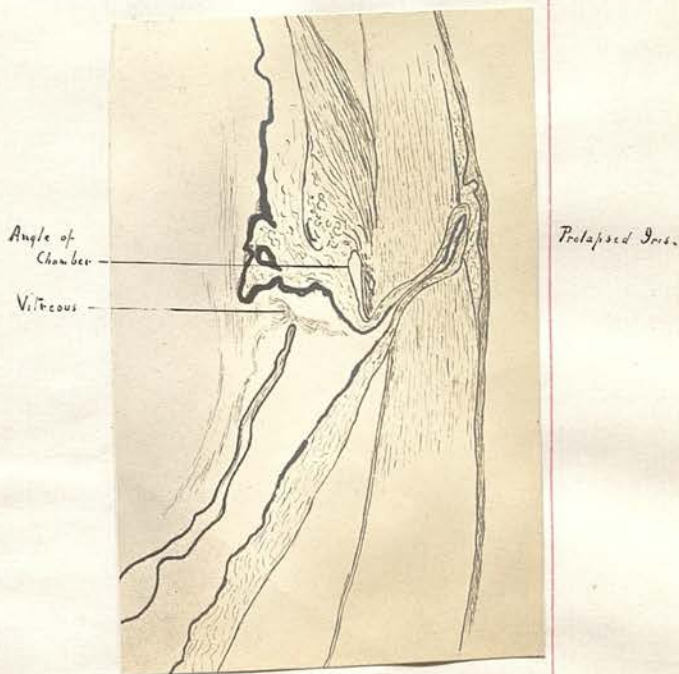


Fig. III.

CASE XVI.

Twenty-eight Days.

History. H. M. aged 68 was operated on 13th May 1879 by Prof. Von Arlt with a Peripheral Linear Incision. The lens was easily extracted but as patient was very restless some lens matter was left behind and the External Pillar became caught in the wound. On the second night after the operation the patient was sick, in consequence of which, the wound was burst and the Anterior Chamber was partially filled with blood. The following day the patient developed pleurisy of which he subsequently died 28 days after the operation.

Fig. I. shows a condition exactly similar to the two preceding cases - a Capsular combined with an Iris Prolapse. The Iris at the centre of the Coloboma has been pulled out altogether from its attachment so that in the figure no traces whatever of it are present.

The Angle of the Anterior Chamber is filled by loosely packed spindle cells derived from the mass of connective tissue that has grown down the wound track into the Anterior Chamber, a condition exactly similar to Case XIV.

That these cells are not derived from any inflammatory reaction is shown by the fact that sections going through the pillars of the coloboma,

Fig. 2. show the Iris free from Inflammatory reaction and the Angle of the Anterior Chamber open, the Prolapsed Iris preventing the Connective Tissue from gaining direct access to the Angle though it has nevertheless grown down the upper aspect of the Prolapsed Capsule, between it and the Iris, and so eventually comes to lie between the equator of the Lens Capsule and the Iris Root.

The Capsular Epithelium at the Equator of the Lens Capsule is well marked and this when traced forward loses its cubical shape and its cells become flattened and finally end in a mass of spindle shaped cells which lose themselves in the connective tissue downgrowth.

Also similar to Case XIV. Red Blood Corpuscles are to be seen between the Zonular fibres and resting on the Ciliary Body.

The Iris root inferiorly shows a tear with blood extravasation in the Iris tissue and neighbouring part of Ciliary Region.

CASE XVI.

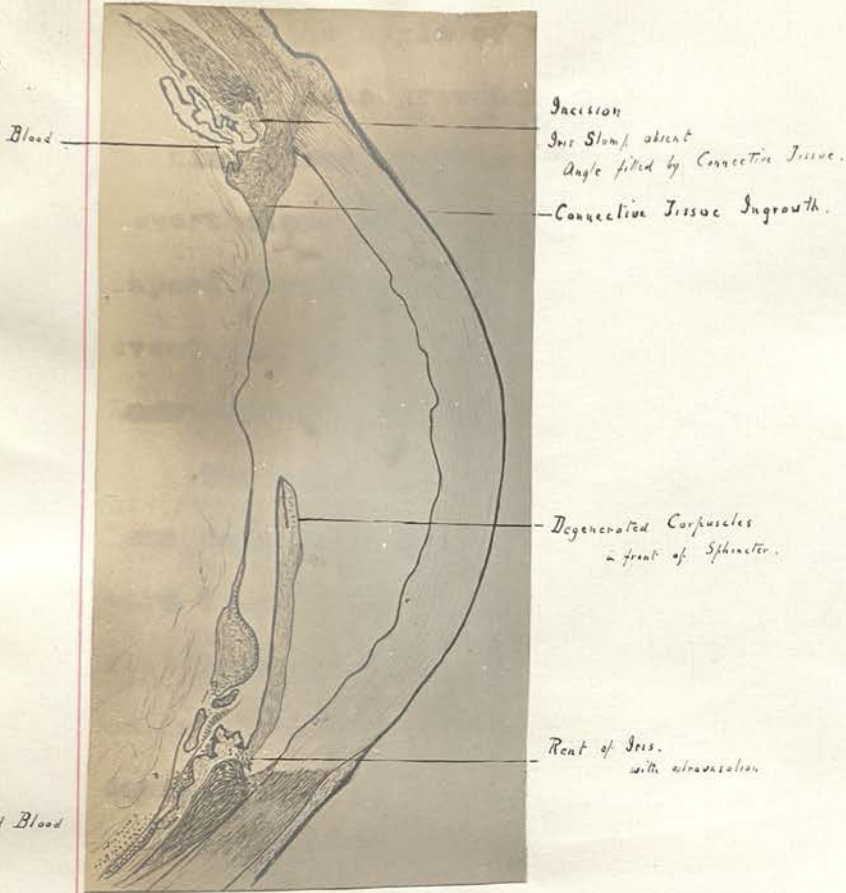


Fig. I

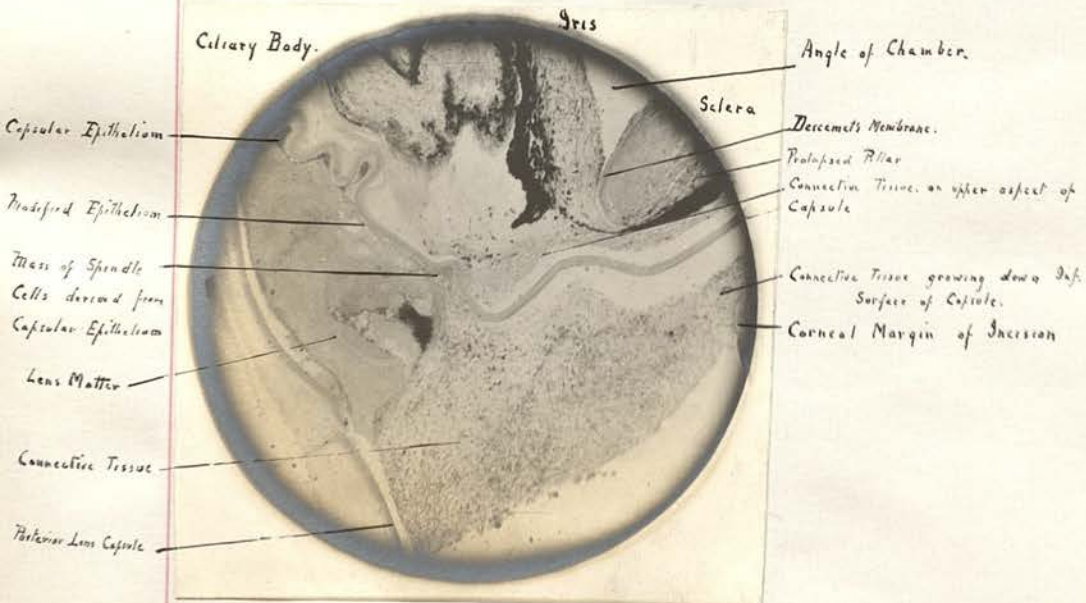


Fig II.

CASE XVII.

Twenty-seven Days.

History. A case of Mr Richardson Cross which died 27 days after simple extraction.

The Wound is corneal and down both its lips at the centre of the Incision the superficial epithelium as in Case I. has grown down and is just turning round both inner margins to grow along the posterior surface of the Cornea (Fig. I.) only here it has taken four weeks to do what in Case I. took three days, owing possibly to the difference in the vitality of the tissues concerned in the two cases.

Another point of similarity in the two cases is the fact that here also the Choroid is detached above and below (Fig. II.) following possibly from the diminution of tension resulting from a leaking wound.

CASE XVII.

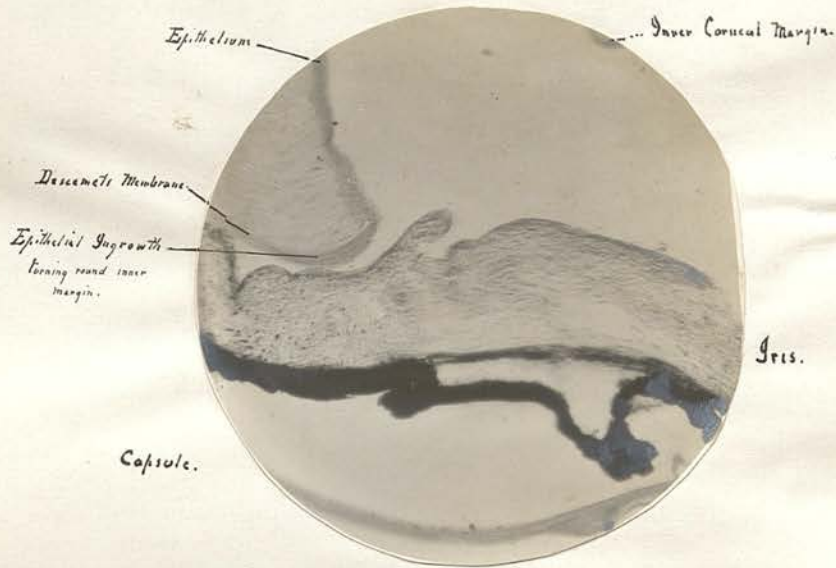


Fig. I



Fig. II.

CASE XVIII.

Jäger's Incision.

History. The Case was operated after Jäger's Linear Incision made by a hollow ground concave knife.

The Incision 9.5 mm. in length begins and ends in the Sclera, its centre crossing the clear corner 1 mm. below the Limbus. The cicatrix is entirely solid and very thin, and difficult to make out especially in the Sclera.

The Coloboma 5 mm. broad has its internal pillar caught.

Only a very thin secondary cataract present which is membranous especially superiorly on that side where the sphincter edge is drawn up, where there is a thick white streak present, with finer radiating opacities extending from it towards the pupil.

Fig. I. and II. are taken from Vertical Sections of outer half of the Incision and therefore away from the Iris Prolapse.

Fig. I. shows a well-healed and firm, though broad cicatrix.

Fig. II. from a still more external part of the incision shows the Lens Capsule adherent to the inner half of the wound, the outer half being firmly united, by fine bundles of connective tissue which

run parallel to the corneal lamellae. At the Inner half lies the Lens Capsule on whose under surface has crept in Connective Tissue which is attached to the Posterior Capsule.

It is this which forms the white membranous streak mentioned above in the history.

The Inferior surface of this Mass towards the Cornea is lined by a thin homogeneous membrane, most marked and distinct anteriorly but closing itself as it is traced back, which can only be a formation analagous to Descemet's Membrane, the consequence of the activity of the Posterior Endothelial Cells, which come to cover the ingrowth of Connective Tissue cells, and lay down a new Descemet's Membrane, which naturally will be most marked anteriorly where the Endothelium will first have started to cover the mass.

The Iris Stump has its cut surfaces directed backwards, due to the uncontrolled action of the Dilator, while the Pigment Layers are partially detached in Fig. II.

CASE XVIII.

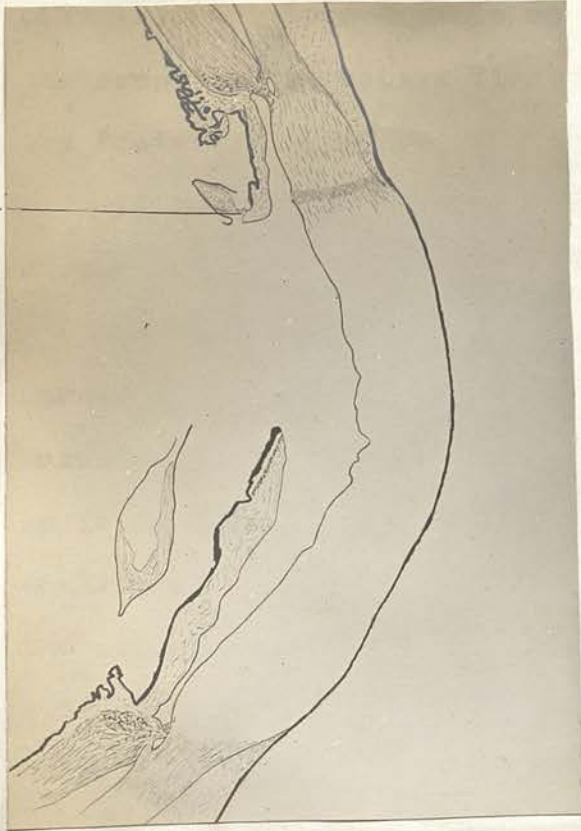


Fig. I.

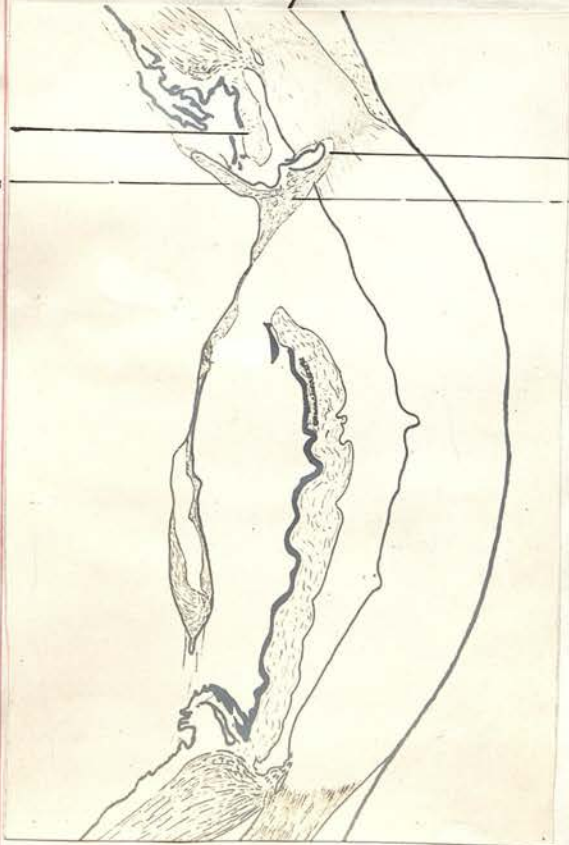


Fig. II.

Cut surface directed back

Incision

Iris Stump with Detached Pigment. Lens Remains

Incision with incarceration of Capsule or Ingrowth of Limbus Tissue. lined by a thin Homogeneous Membrane.

## CASE XIX.

The Patient died a month after Graefe's Extraction had been performed.

Fig. I taken from a section through the centre of the Coloboma shows how perpendicularly to the surface the Incision runs and the Iris Stump which is torn at its root, adherent to its upper margin causing gaping of the wound and so permitting the Subconjunctival Tissue to grow in and become attached to the Lens Capsule and so pull it forward.

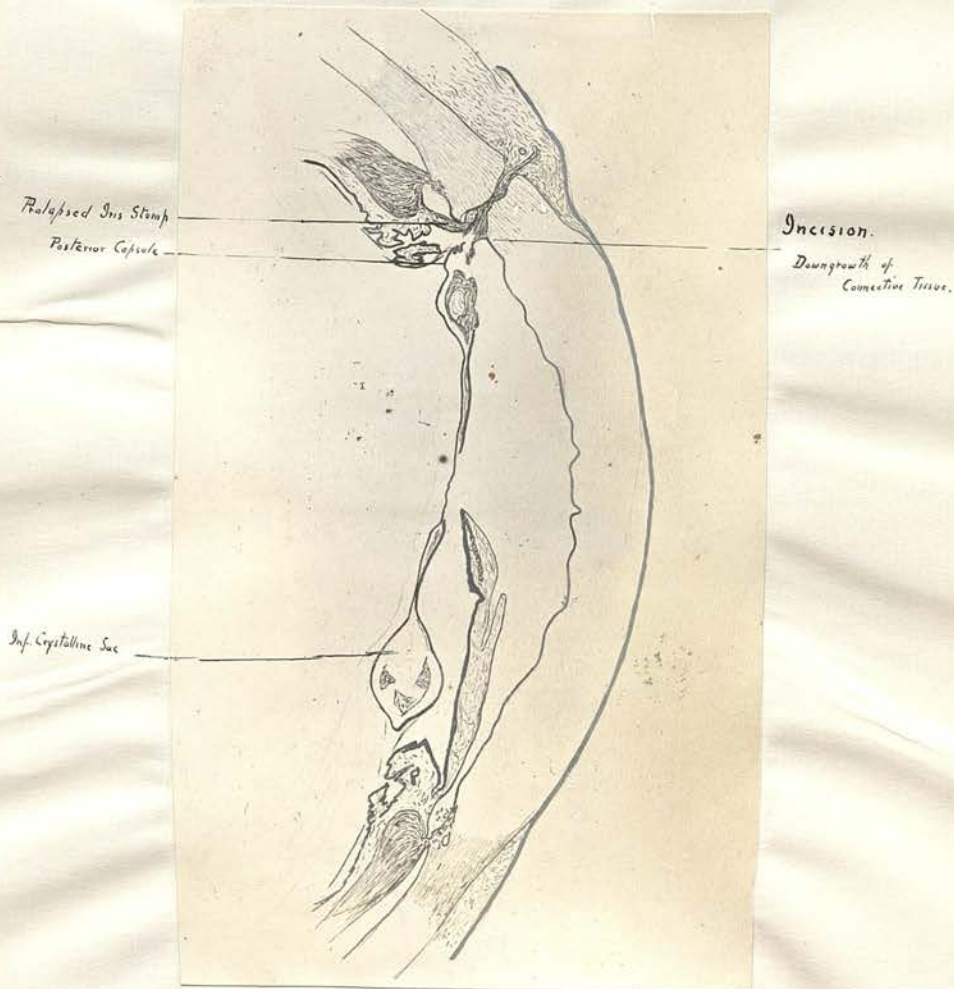


Fig. I.

CASE XX.

The Case was operated after Graefe's Method though there is no record of how long previously the operation was performed. That it is however an early case is evident, by the fact that the Intercalary Mass, consists of young Connective Tissue Cells, which run in a direction perpendicular to the surface, as is always the case in the early stages of healing.

The Iris Stump is incarcerated in the Wound, permitting the subconjunctival tissue filling the outer half of Incision.

The gaping of the wound internally is artificial, being caused by shrinking.

The superior Ciliary Body is pulled forward in consequence of the prolapse, which however does not prevent the Angle of the Anterior Chamber being open.

CASE XX.

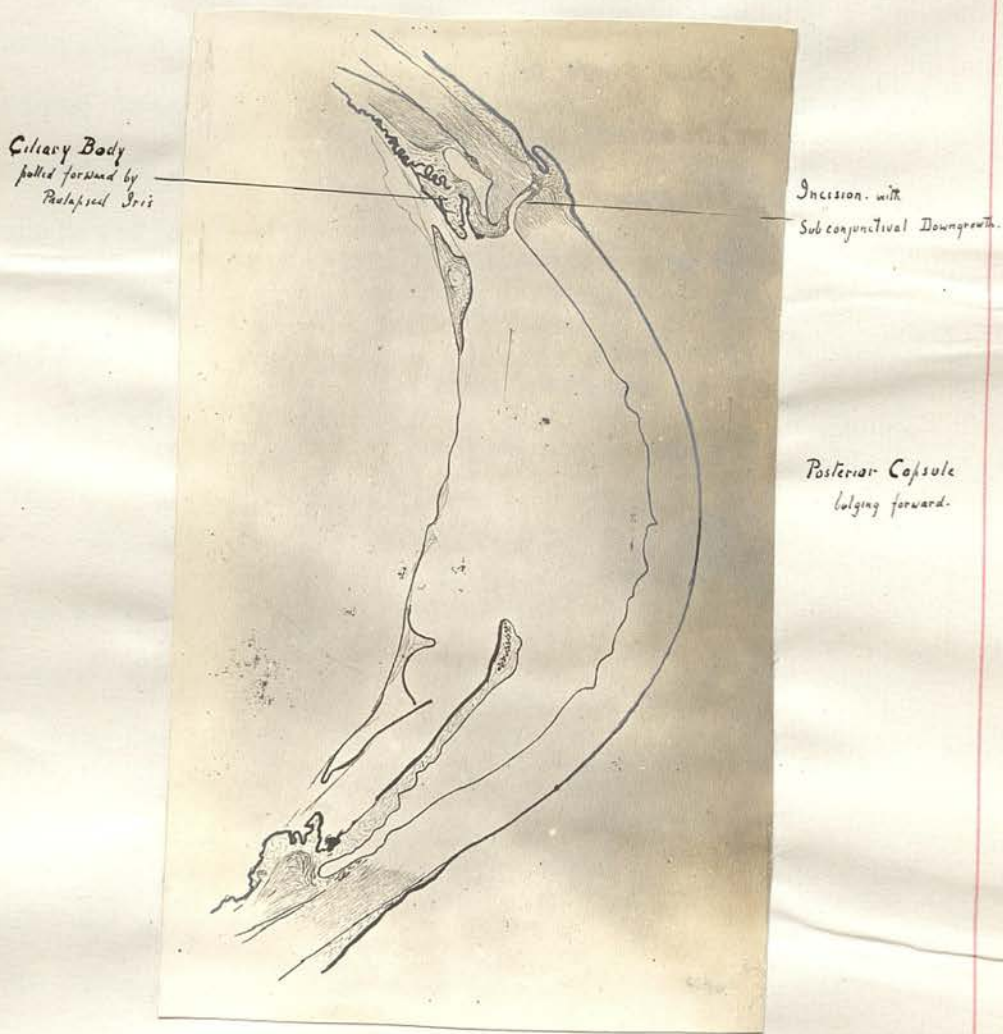


Fig. I.

## CASE XXI.

From a P.M. case, operated on by a Peripheral Linear Incision.

Incision runs vertically to the surface and between the lips there lies an Intercalary Mass derived from the Subconjunctiva. There is no date given as to how long previously the case had been operated on, but the case is instructive as showing an intermediate stage in the healing, for in date it must lie between the early cases of a month and under, which have preceded this and the old cases which make up the rest of this series.

For here the Intercalary Mass is in a transition stage, well shown in sections stained after Van Gieson's Method, by which fibrous tissue is stained a deep red, while embryonic tissue is coloured yellow. Thus is thrown up into marked contrast those cells which are being converted from embryonic tissue into fibrous tissue, the direction of whose fibres is at the same time being changed from a direction parallel to the wound surfaces, to one running more or less in the same direction as the corneal lamellae, though what induces this change in direction I am unable to state.

That it is certainly not caused by an interpolation of corneal corpuscles into the Intercalary Mass

is shown by the margins of the Incision not manifesting any active regenerative changes, as would certainly be the case if the cornea took an active part in the process of uniting the wound, which it would appear to leave altogether to the ingrowth of the extraneous tissue to do.

The inner extremity of wound is shut off from the Anterior Chamber by the Posterior Endothelium which has grown over it.

Another proof that this case is not a very old one, not more than a month or so, is shown by the Detachment of the Choroid present in vertical sections both above and below, demonstrated by the presence of Albuminous matter in the supra choroidia.. The Iris Stump at one point of the Incision is caught and adherent.

CASE XXI.

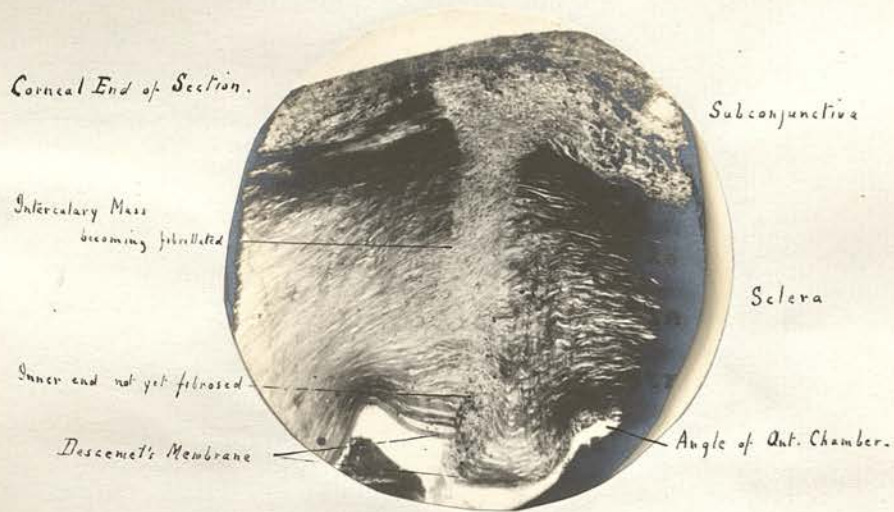


Fig. I.

## CASE XXII.

From a P.M. Case.

The wound is well and firmly healed, the space between the severed ends being filled by fibres running parallel to Corneal Fibres, derived from the subconjunctival tissue.

The bundles which these cells make are much smaller and more irregular than the corneal lamellae which they unite.

Vessels are to be made out running down into the wound. The Connective Tissue of the wound is attached to the lens capsule, so dragging the superior capsular sac forward and obliterating the circumlental space superiorly.

The connective tissue has grown in behind this displaced sac, the inferior margin of which, as in Case 18, is covered by the Posterior Endothelium, which has formed a thin Homogeneous Membrane on its surface. A similar membrane extends from the Scleral part of Descemet's Membrane along to upper margin of the connective tissue intrusion to the capsular sac. The rest of the Lens Capsule is missing except for a small remnant of the Equatorial Region of the Capsule, which has been pulled up out of its normal position, though still connected with the Ciliary Body by long drawn out Zonular Fibres, and lies resting on the Pupillary Border of the Iris.

The Iris Stump superiorly is absent, the Iris having been pulled out from its attachment. A similar condition exists below, where Iridodialysis exists.

A striking feature to be noted here is the lack of reaction or at any rate any cicatricial processes manifested by either the Ciliary Body or Iris, as one might expect after such trauma.

## CASE XXII.

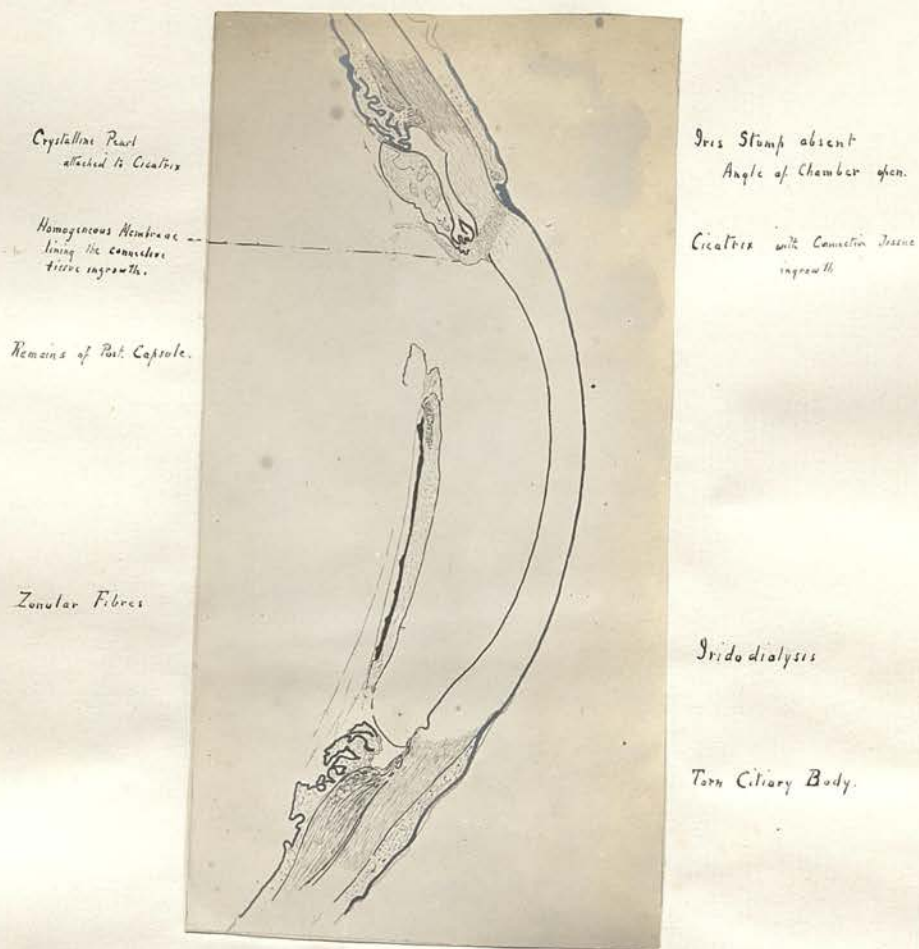


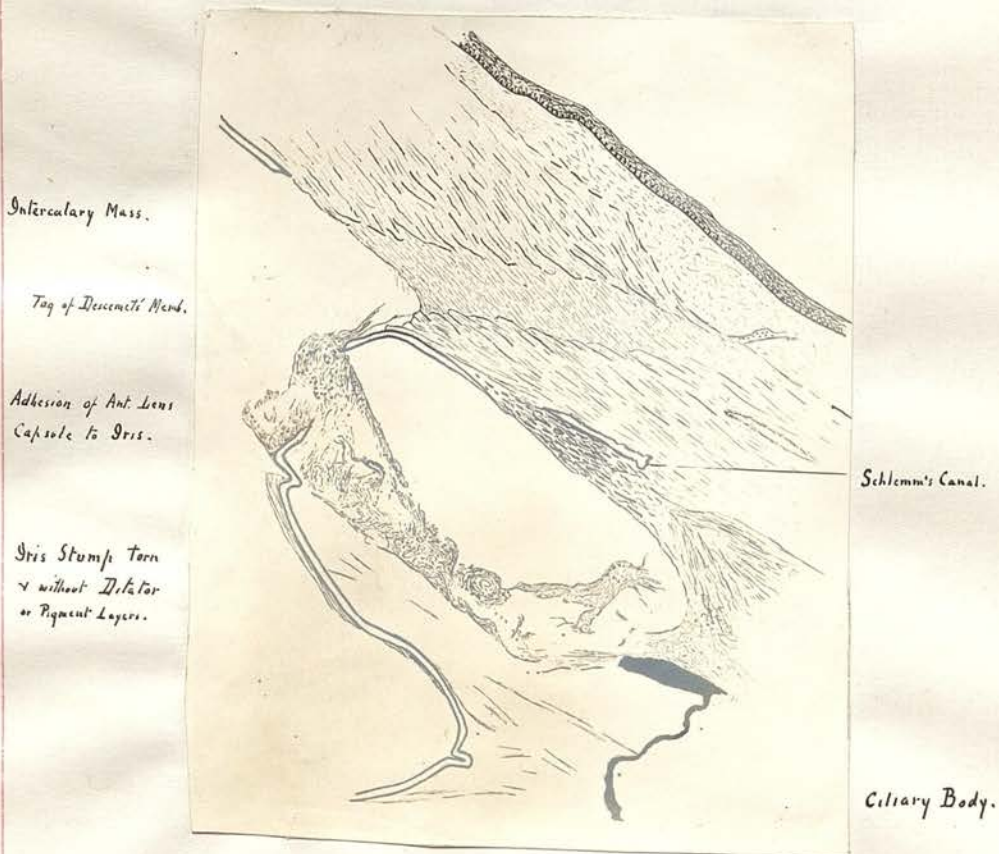
Fig. I.

## CASE XXIII

An Oblique and somewhat peripheral Incision which owing to Incarceration of Iris Stump has gaped.

In the Scleral End there is a distinct tag of Descemet's Membrane pulled inwards by the Iris Stump, which is totally devoid of Dilator and Pigment layers besides presenting a rent towards the angle of the Anterior Chamber, but not characterised by marks of any inflammatory reaction.

The Remnant of the Anterior Capsule is adherent to the Iris Stump.



CASE XXIV.

Extractio Cataractae in Oculo Myopico, in a patient aged 59, though how long previously not stated.

Wound well healed, the gap between the originally severed corneal lamellae measures .2 mm.

The Anterior Lens Capsule is adherent to the Inner margin of the wound and then hangs downwards into the Anterior Chamber in a convoluted mass bound together by the proliferation of the Capsular Epithelium.

On account of this anterior synechia of the capsule there is superiorly no capsular sac or "wulst" formed, though inferiorly it is present. The Iris has been completely detached from its attachment as result of formation of Iridectomy, which nevertheless does not present any Cicatrisation or Pigmentation, as might be expected.

The Ciliary Muscle and also processes are not well developed being of the Myopic Type.

CASE XXIV.

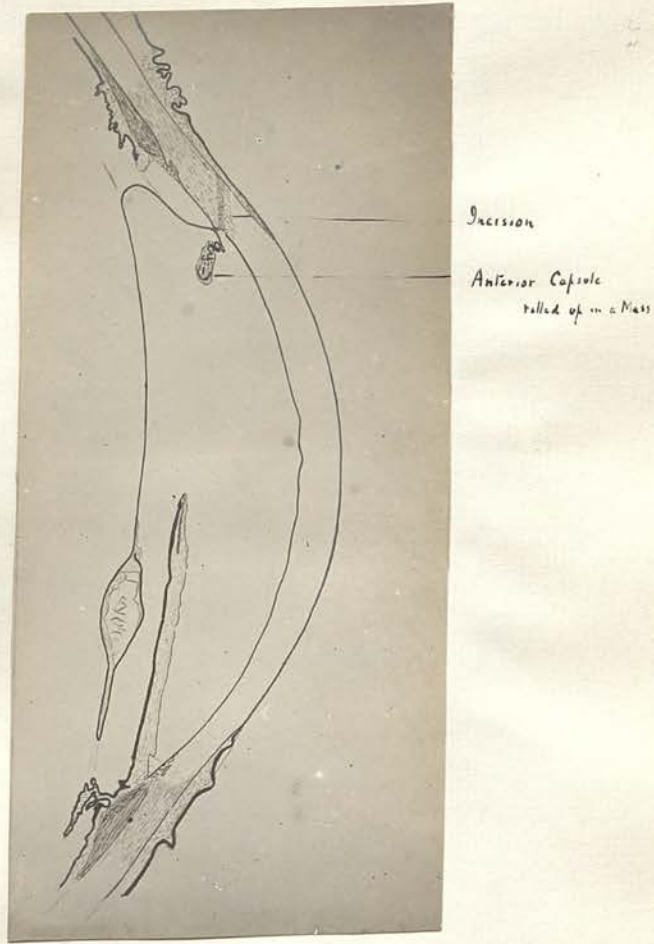


Fig. I.

CASE XXV.

History. An old Aphakic eye with tendency to Glaucoma. The patient was 77 when he died.

The corneal epithelium was thickened, swollen and vacuolated, characteristic of lymph stasis.

As in Case 22 the lens Capsule is adherent to the inner margin of Incision and a homogeneous Membrane derived from the Posterior Epithelium covering the Connective Tissue Ingrowth.

The Iris superiorly has been pulled out completely. The Circumferential space is obliterated above as so is the Angle of the Anterior Chamber in consequence of the position which the Superior Capsular Sac has assumed.

The Anterior Chamber is filled with an Albuminoid material in consequence of chronic cyclitis, which has possibly been the starting point of the glaucoma.

The occlusion of the Inferior Angle of the Anterior Chamber is well seen.

The Pupillar End of Iris is attached to the Posterior Capsule by a mass of spindle shaped cells most possibly derived from the Capsular Epithelium of the Anterior Capsule which is here everted. There are two marked Crystalline Pearls the inferior one showing calcareous degeneration of its contents.

CASE XXV.

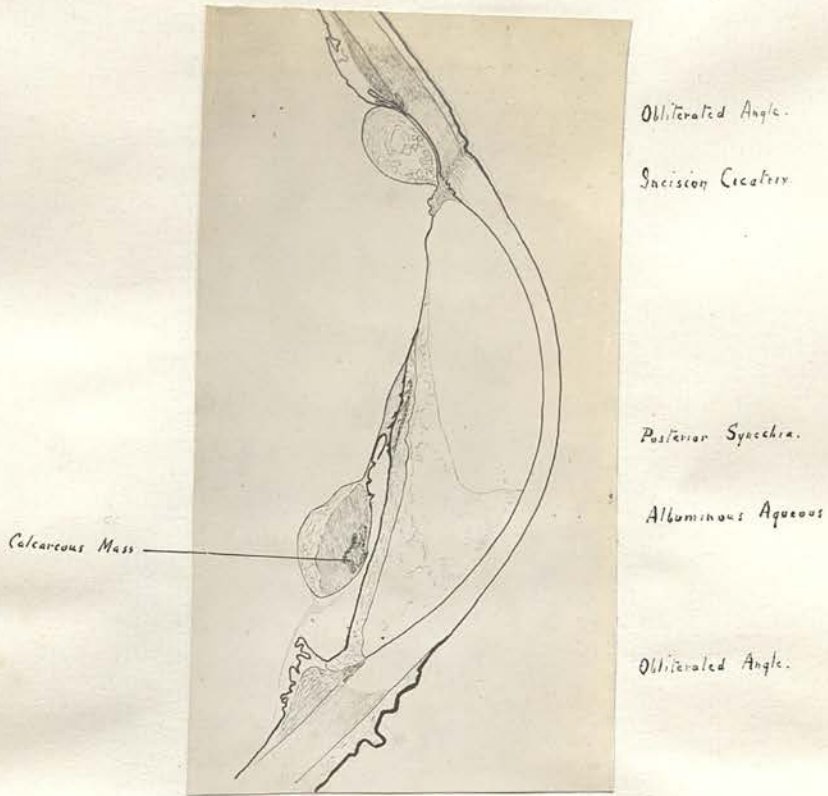
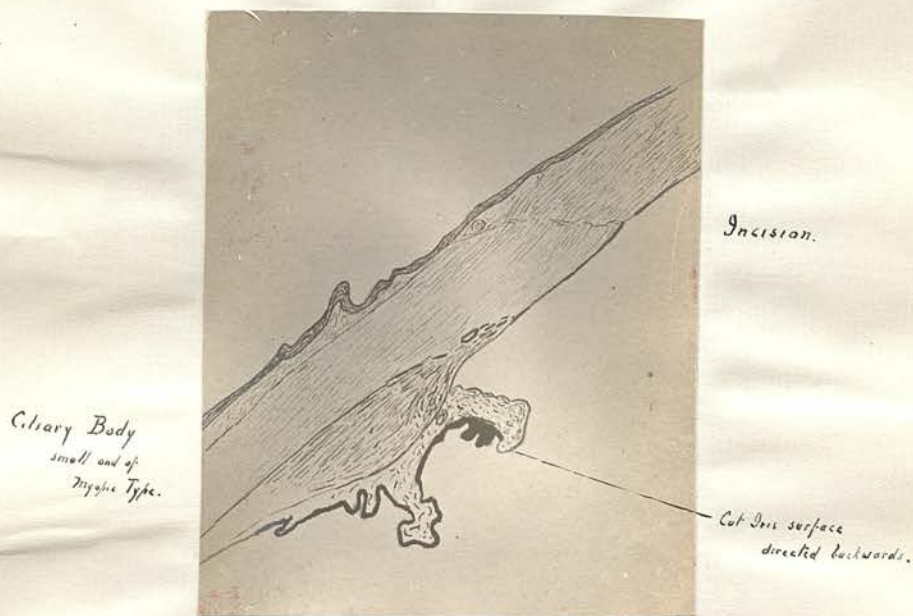


Fig. I.

## CASE XXVI.

This case shows the linear cicatrix that follows when lips are in good apposition.

Iris Stump small and its cut surface is directed backwards as is also seen in Case 18, Fig. I, due to action of the Dilator Pupillae.



*Fig. I.*

## CASE XXVII.

Fig. I. shows an Anterior Synechia of the Iris Stump to the inner margin of wound, which only exists at one part of the incision.

Note the broken and curled piece of Descemet's Membrane, and the open Filtration Angle.

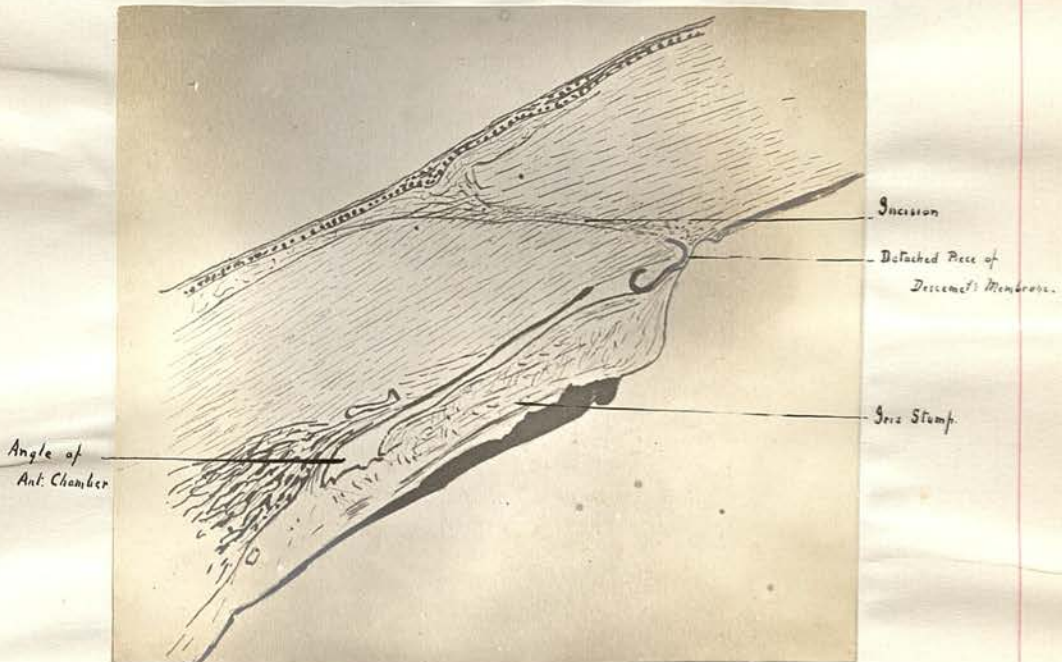


Fig. I.

CASE XXVIII.

History. The Patient died four years after successful Graefe's extraction.

The Incision lies 1.8 mm. from Posterior end of Schlemm's Canal and runs perpendicularly to the surface.

The lips having been in excellent apposition the wound has healed with the minimum interposition of connective tissue.

Capillary Blood Vessels can be seen in the cicatrix. Owing to the shrinking resulting from cicatrization the vertical measurement of the cornea at the site of the cicatrix is much less than elsewhere which is well brought out in Fig. I., as also are the fine more or less parallel fibres constituting the cicatrix. Descemet's Membrane has been cut in the same plane with the corneal lamellae and therefore its severed surfaces are cut square. They are joined together by a new formation of Homogeneous Membrane, which projects slightly into the cicatrix.

The Iris Stump which is 1 mm. long presents signs of trauma without any signs of Inflammatory reaction, its cut surface shows no cicatrization - in fact the Iridectomy might have been just recently done for the Iris tissue is here quite free and open

towards the Aqueous. At its root the Dilator is torn from its attachment, while the posterior pigment layers project from the stump and hang free into the Anterior Chamber, where they possibly swung to and fro with every movement of the eye for the four years during which the patient benefited by the operation.

The posterior Capsule stretched unbroken across the pupil with a well formed "Crystallwulste" at either end.

CASE XXVIII.

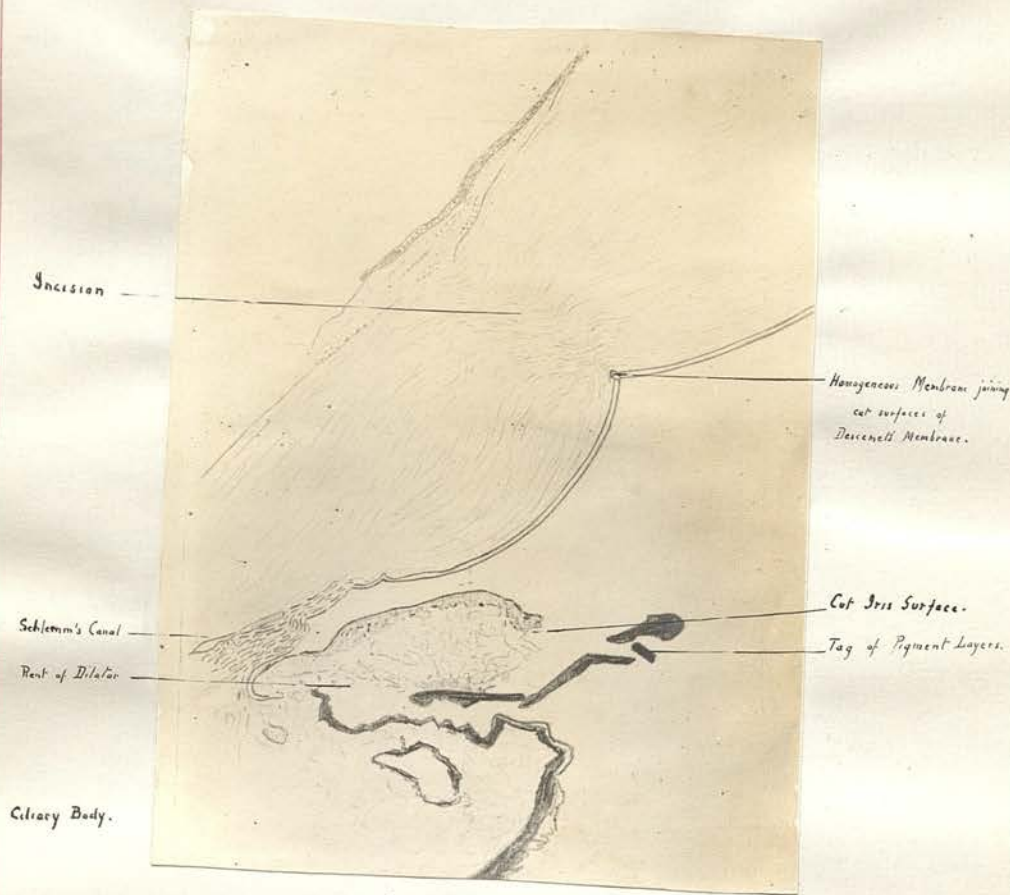


Fig. I.

CASE XXIX.

History. The patient was brought into Hospital in a comatose condition suffering from Embolism of Brain from which he died. The extraction probably done a considerable time previously.

This case is very like the last. The Incision was healed by primary union so that the line of the cicatrix can scarcely be traced. The constriction it forms in the posterior aspect of the cornea is well marked.

The cut extremities of Descemet's Membrane are united by quite a thick new formed Membrane, the thickness of which shows that the case is an old one as it takes the Posterior Endothelium a considerable time to form a membrane of an appreciable thickness.

The Stump of the Iris is very small only .5 mm. The dilator along with the Pigment layers has been detached leaving the posterior surface of the stump denuded.

In the section, however, from which Fig. I. is taken a peculiar condition exists not well brought out however under such a small magnification, for here while the Dilator has been pulled out from its origin at the Ciliary Body, the Pigment Layers have been left behind forming a small tag which hangs down behind the Iris Stump and free from it.

There are two well marked Crystalline Pearls on either side of the tightly stretched Posterior Capsule, presenting an extensive circumlental space especially marked superiorly.

70  
CASE XXIX.

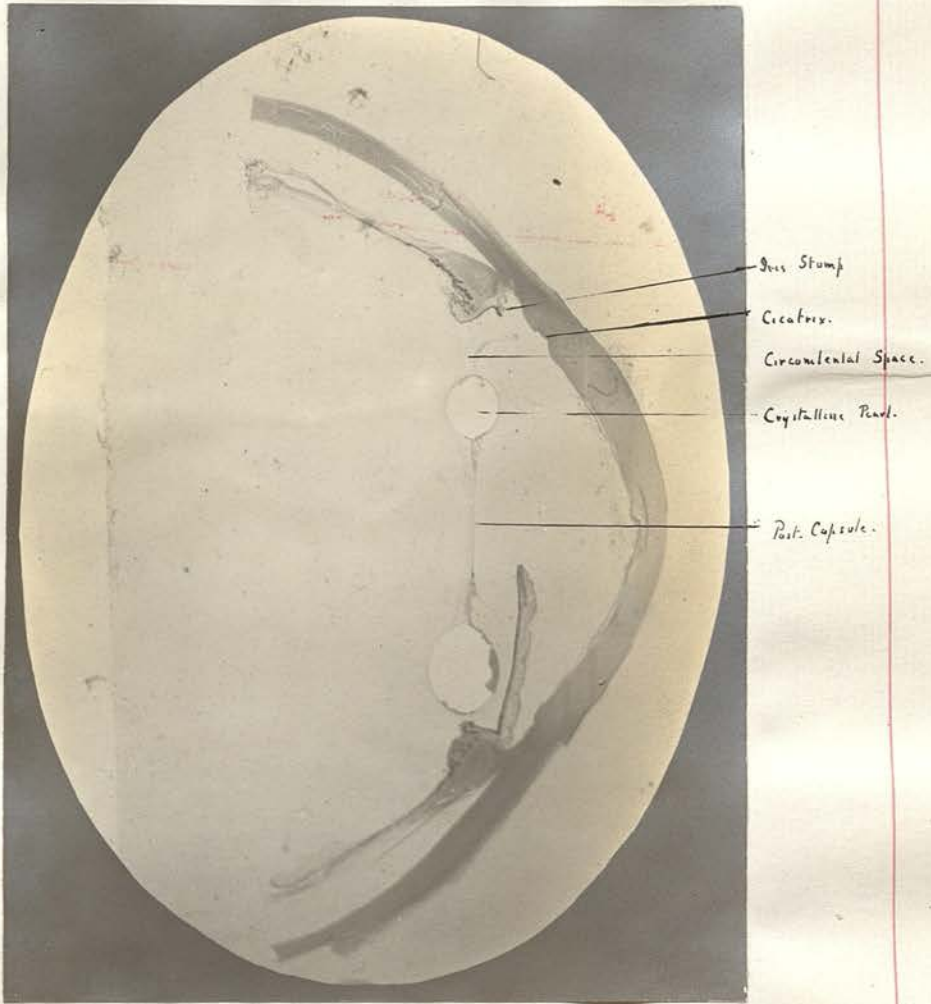


Fig. I.

## CASE XXX.

The case was operated by a Peripheral Linear Incision, which goes through the Pectinate Ligament. The Iris Stump was incarcerated in the wound.

Fig I. shows well how even with an Incarceration so close to the Angle of the Anterior Chamber and in fact involving the Pectinate Ligament the Angle of the Anterior Chamber is not occluded, and that therefore an Incarceration or Prolapse of Iris does not per se favour the occlusion of the Filtration Angle but that there must be some primary cause behind it, either an Inflammatory attack or some pre-existing disposition to Glaucoma.

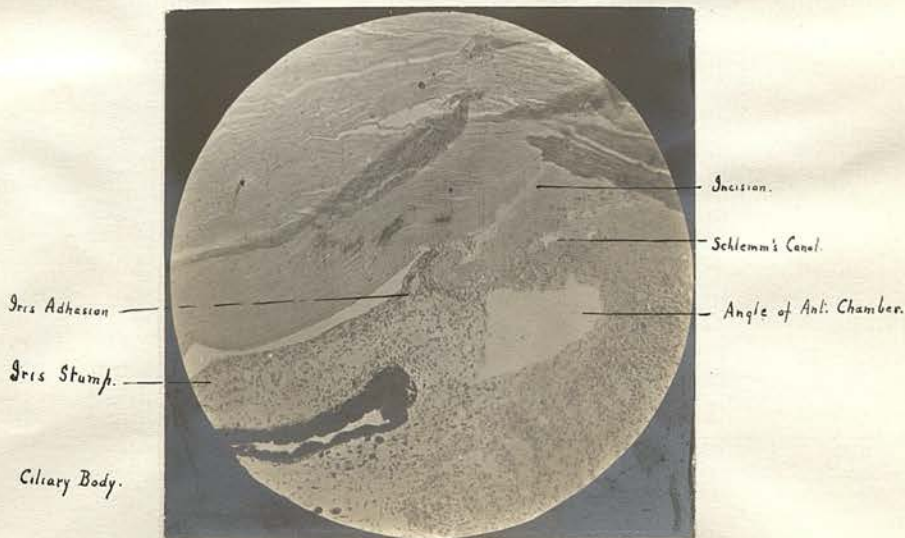


Fig. I.

CASE XXXI

History. Simple extraction two years before.

On leaving Hospital the Patient sustained a blow on his operated eye which was followed by a Traumatic Keratitis, which left a dense central opacity in the cornea.

Fig I shows the Cornea opposite the Pupil markedly thickened and the Posterior Capsule bulging forward and attached to it, and so causing the central opacity described in the History.

The wound is well and firmly healed (Fig. II) the pupillary edge of the Iris is caught in the cicatrix.

The Pigment Layers at a point opposite the superior crystalline sac have been rubbed off.

CASE XXXI.

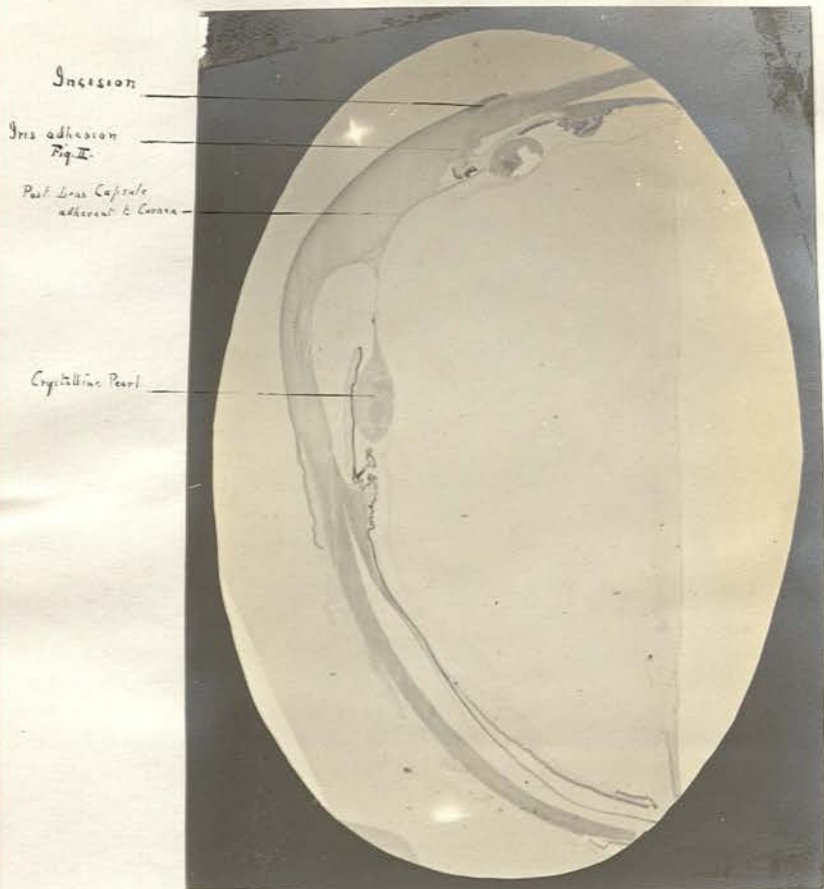


Fig. I

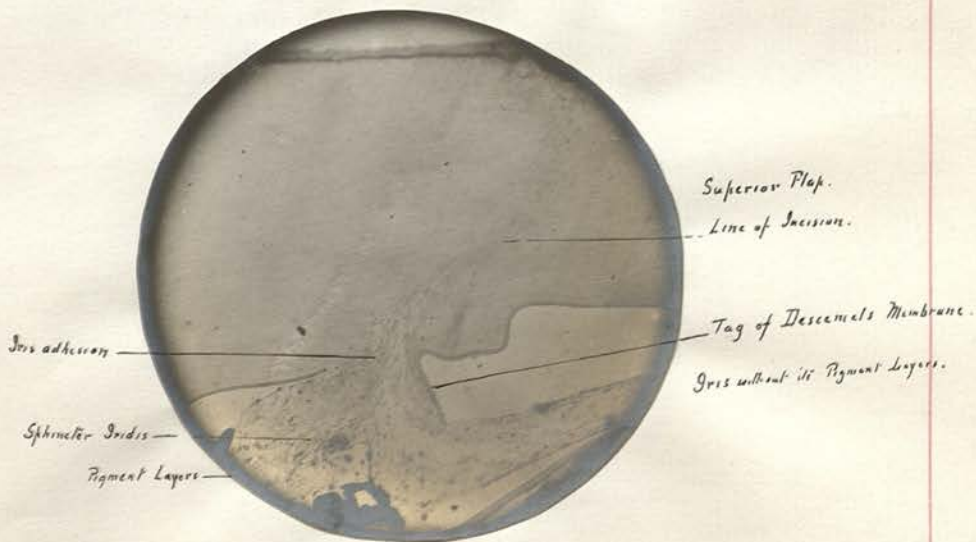


Fig. II.

CASE XXXII.

This case is published by Prof. Fuchs in his recent Bowman Lecture.

History. The eye was enucleated four years after extraction on account of pain and glaucomatous tension, accompanied by Keratitis Bullosa. The cause of these Clinical Manifestations is the formation of an Anterior Chamber Cyst, at any rate the growth of the surface epithelium into the Anterior Chamber, the upper two thirds of which it lines, as is illustrated in Fig I. The overgrowth of Pigment that occurs in consequence of the increase of Tension is here well shown especially superiorly, where the Pigment of the Iris Stump is seen growing backwards along the Zonular Fibres.

Fig. II shows the point where the Epithelium has been able to enter into the Anterior Chamber, owing to an incarceration of the Iris Stump keeping the lips of the Incision open.

CASE XXXII.

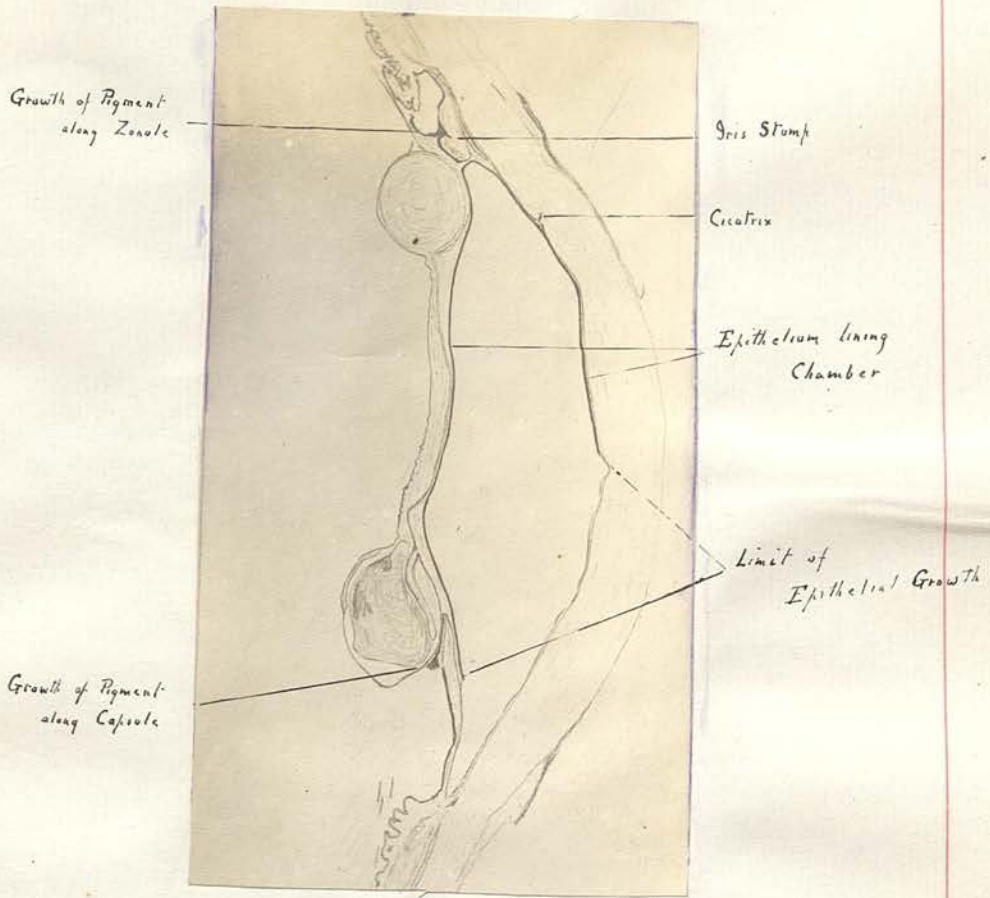


Fig. I

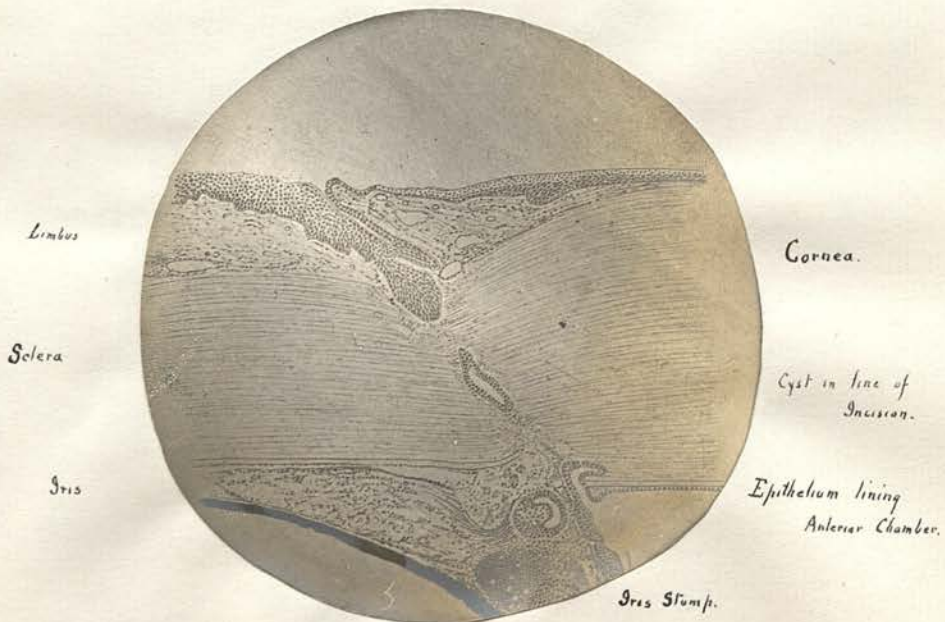


Fig II  
After Prof. Fuchs.

## CASE XXXIII.

History. This case, which first came under Mr Richardson Cross' care in 1898 is in every way a counterpart of the preceding case of Prof. Fuchs.

The Patient, aged 36, had had cataract extraction, with subsequent needling performed in his R.E. the previous year, i. e., in 1897.

In November 1898 R.V.  $\bar{c}$  + 11 D.C. + 3 D. Cyl. Axis H.  $-\frac{6}{18}$ .

The eye then showed a coloboma upwards with incarceration of inner pillar and a dense capsular Cataract. By March 1902 R.V. was reduced to fingers at 1 m. In August the Patient returned complaining that the Right Eye had been so painful for the past two months, that he wished it removed. The Eye was then red and injected and painful to touch.

The Cornea was very dull and hazy, so that little could be made out of deeper parts. The tension, however, during the three days he remained in hospital before operation was not elevated. Keratitis Bullosa developed the evening before the eye was enucleated. Vision was reduced to mere perception of light.

The appearance of a vertical section at the centre of the Incision shows a condition exactly similar in every respect to Fig. I. of the preceding case.

Fig. I. shows the cicatrix lying just with the

limbus and the constriction resulting from its contraction, with overriding of the Corneal over the Scleral Surface.

Fig. II. illustrates the layer of Epithelium crossing from the posterior surface of Cornea to the anterior surface of Iris Stump, which is torn from its attachment to the Ciliary Body.

Fig. III. shows where and how the Surface Epithelium has entered the Anterior Chamber.

It is taken from a vertical section going through the Internal Pillar of the Coloboma which, as we have seen, was incarcerated and therefore permitted the Epithelium to enter the depths of the wound.

The corneal wound is here occupied mainly by a large cyst lined by a triple layer of Epithelium and bounded externally by thin cicatricial tissue, on either side, by the margins of the wound, while internally, by the Iris tissue which has been caught in the wound.

Although of such an extensive size, occupying as it does, almost the whole of the margin of the wound, while measuring from above down as much as 1-18 m.m., yet the cyst did not present any signs in vitam.

This is the only case in the series in which there is a record of Astigmatism which here amounted to 3 D. which can be accounted for by the gap existing between the wound surfaces resulting in the increase of the radius of vertical meridian.

CASE XXXIII.



Fig. I.



Fig. II.

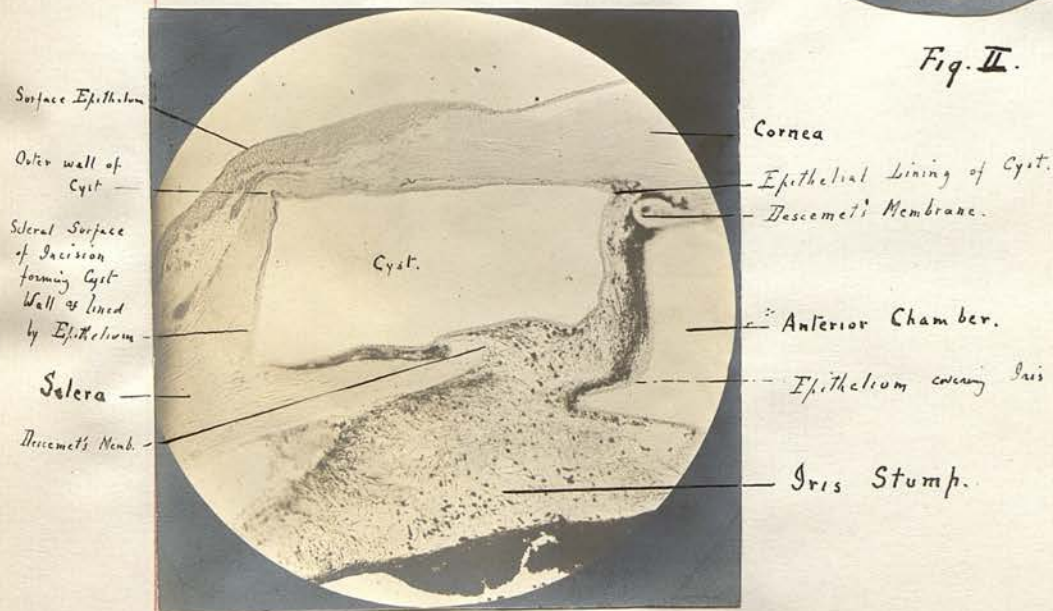


Fig. III.

TABLE I.

	Measurement of Inner Margin of Incision from Posterior End of Schlemm's Canal.	Length of Iris Stump.
<u>Case.</u>	<u>Modern Flap Incision.</u>	
XXXII.	2.66 m.m.	1.33 m.m.
IX.	2.23 m.m.	T. 1.7 m.m.
II.	2.17 m.m.	T. .93 m.m.
XXIII.	2.2 m.m.	Nil.
I.	2. m.m.	1.33 m.m.
XXV.	1.8 m.m.	Nil
XXVII.	1.8 m.m.	1.4 m.m.
V.	1.75 m.m.	1. m.m.
XXVI.	1.7 m.m.	.7 m.m.
IV.	1.7 m.m.	P
XI.	1.65 m.m.	T. .7 m.m.
VI.	1.57 m.m.	T. .35 m.m.
XXIV.	1.54 m.m.	Nil.
	<u>Graefe's Incision.</u>	
XXVIII.	1.8 m.m.	T. 1. m.m.
XXIX.	1.4 m.m.	T. .5 m.m.
XX.	1.26 m.m.	P
XII.	1.24 m.m.	.91 m.m.
XIV.	1. m.m.	T .56 m.m.
XIX.	.94 m.m.	.77 m.m.
XXI.	.9 m.m.	.45 m.m.
XXIII.	.9 m.m.	T. 1.4 m.m.
VII.	.8 m.m.	T. .94 m.m.
XVI.	.78 m.m.	.3 m.m.
XV.	.74 m.m.	P
VIII.	.64 m.m.	P
XXX.	.36 m.m.	P
	<u>Simple Extraction.</u>	
XXXI.	2.65 m.m.	
X.	1.96 m.m.	
XIII.	1.5 m.m.	

T = Iris Stump torn.  
P = Stump prolapsed.

TABLE II.

Cases showing Extravasation of Blood in front of Sphincter Iridis.

Case	I.	-	3	days	after	operation.
	III.	-	3	"	"	"
	IV.	-	6	"	"	"
	V.	-	7	"	"	"
	VII.	-	8	"	"	"
	XII.	-	15	"	"	"
	XVI.	-	28	"	"	"

TABLE III.

Cases where Ciliary Body and Choroid are detached.

Case	I.	-	3	days	after	operation.
	III.	-	3	"	"	"
	V.	-	7	"	"	"
	VI.	-	7	"	"	"
	IX.	-	13	"	"	"
	XII.	-	15	"	"	"
	XVII.	-	28	"	"	"
	XXI.	-				

TABLE IV.

Cases showing downgrowth of Connective Tissue  
into the Anterior Chamber, with Prolapse of Capsule.

Case	XIV.
"	XV.
"	XVI.
"	XVIII.
"	XIX.
"	XXII.
"	XXV.
"	XI

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