On a rare form of primary opacity (Transverse calcareous film) of the cornea / by Edward Nettleship.

ON A RARE FORM OF PRIMARY OPACITY (*TRANSVERSE CALCAREOUS FILM**) OF THE CORNEA.†

By EDWARD NETTLESHIP, F. R. C. S.

THE disease referred to in this paper has long been known to surgeons, and is mentioned in most of the modern systematic works on diseases of the eye. A certain number of cases and observations upon the subject (some of them with excellent descriptions and plates) have been published from time to time, but for the most part observers do not seem to have thought it worth while to record their cases in detail. The disease is a rare one, generally very unobtrusive until well advanced, and it occurs for the most part in elderly people; facts which have led to its being often looked on mainly as a curiosity. The first case that I had the opportunity of observing in detail was at Moorfields in 1873, and I have to thank Mr. Hutchinson for allowing me to use the notes of this and of two other cases which have come under his care more lately (Cases 3, 4 and 5.)

The occurrence quite lately of two good examples of it among my patients at the South London Ophthalmic Hospital, led me to examine previously recorded cases and accounts of the disease, and with the result of finding that the subject, although a very small one, appeared to have points of general interest which had not hitherto been suf-

* This disease has received various names, *i. e.*, Symmetrical Opacity of Cornea, Transverse Opacity, Ribbon-shaped and Girdle-shaped Opacity, Calcareous Film of Cornea.

† This paper was read before the Medico-Chirurgical Society of London, April 19, 1879.

ficiently dwelt upon, in addition to being an affair of some local importance to the eye itself.

In this malady *the exposed part* of the cornea is slowly invaded in a nearly transverse direction beneath the epithelium, by a patch, or two patches, of superficial opacity, oblong or oval in shape, and so opaque when fully formed as quite to hide the corresponding parts of the iris and pupil. The opacity can be scraped or chipped off, and is composed of minute crystals, chiefly calcareous. There is never the least trace of ulceration, nor does the corneal epithelium as a rule show any change, either in smoothness, transparency or general level. The limits of the opacity are well defined, usually, indeed, quite abrupt, and the rest of the cornea is perfectly clear. Sometimes there is a history that the eyes have been irritable, but seldom of liability to any special form of ophthalmia or to corneal ulceration. In some chronic glaucoma has come on, but the majority have remained for many years free from complications.

The disease generally begins on one cornea before the other, but always becomes symmetrical in the end.

Before going into further detail I will give the notes of the cases (five in number) which have been referred to.

Case 1.—Wm. Webster, formerly a traveller, but for the last 25 years a private coachman. Tall, sallow, lean, temperate, hair dark gray; in good health; of nervous temperament. Teeth a good deal worn but tolerably good; is not a great meat-eater. For many years liable to occasional attacks of gout in the great toes and knees, and had an attack in the *R.* knee while under care for his eyes, having previously had no attack for eight years. No syphilis. His mother had "a sort of gout" in her fingers. His urine is never thick. He sweats freely. Radial artery decidedly rigid.

At æt. 57, *R.* eye began to fail. Had no material pain at any time.

Æt. 63 (September, 1877), admitted to South London Ophthalmic Hospital for slight ciliary congestion and tenderness of *L.* eye, which, having hitherto been as he thought quite perfect, had lately begun to get dim. Conditions now symmetrical but rather more advanced in *R.* eye, (See Fig. 1).

opacity is exactly where it was nine years ago. The area that had been cleared by operation has however extended a little by the further (spontaneous) separation of the film. The general appearance of the cleared area, however, is not altered, its edge being as irregularly angular and sharply defined as it was the moment after the operation; neither rounding off of the chipped edge, nor fresh deposit, has occurred. The same statements are true of the other eye.

The opacities in the lenses which were present in 1877 have not increased perceptibly.

(*Living specimen. July 2nd*, 1886.)

P.S.—Since the above date I have enlarged the clear space on each cornea by scraping off some more of the film, with advantage to the patient. The scrapings have been carefully examined by Mr. Sidney Plowman, who kindly gives the following report:

"Weight of material ·0025 gramme. Under microscope it was found to consist of unchanged epithelium, of epithelial cells containing rounded, highly refracting granules, and of masses of granules in which all epithelial structure was lost. These masses were made up of smaller aggregations of granules arranged in a rounded, crescentic, or sinuous manner. There was no crystalline structure whatever. Examined microchemically, calcium phosphate and calcium carbonate were found to be present. The presence neither of magnesium nor of urates could be detected."

d-liver oil, salicylic acid, Cascara Sagrada internally, sides leeching, blisters, massage and atropine, and yellow ıtment.

(*Card Specimen. January 28th*, 1886.)

ENDUM to CASE 1. (Trans. Opn. Soc. 1886)

Case of primary calcareous film on corneæ remaining unaltered for nine years.

By E. Nettleship.

The following case was published in detail in a paper On a Rare Form of Primary Opacity of the Cornea," by e author in the 'Archives of Ophthalmology' vol. viii, 293, 1879. The patient, who has been under observa- n from time to time ever since, is now shown in illustra- n of the non-progressive character of this very peculiar sease. He is a lean, sallow coachman, now æt. 72, and rmerly had several attacks of gout in the great toes and ees; for several years past he has been free from gout. Of the two woodcuts, Fig. 1 shows the outline and uation of the patch of light grey opacity on the R.

Fig. 1.

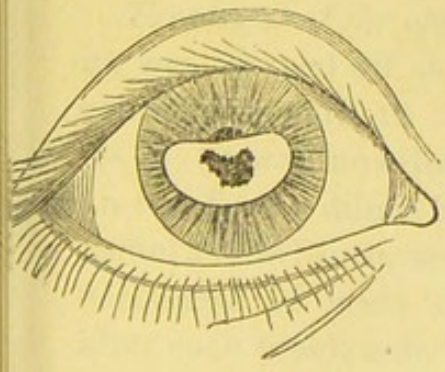
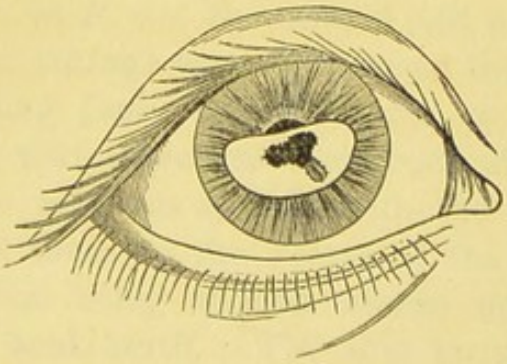


Fig. 2.



rnea in 1877, after the central part had been scraped chipped off; Fig. 2 shows the same cornea at the esent date. It will be seen that the boundary of the

An oval patch or stripe of gray-brown opacity runs almost horizontally across each cornea. The inner end of the oval is the broader; the lower border of the patch curves downwards and is abruptly defined, the upper border is nearly straight and its outline rather softened; the patch terminates at each end 2 *mm.* (more or less) from the border of the cornea; the unaffected marginal part, as well as the upper and lower portions, being perfectly clear. The epithelium over the opacity appears quite healthy and its level is not altered. At the centre of each stripe is a sinuous crack running almost vertically and with some little ones branching off from it, like cracks in china glaze. When magnified, one or two dark dots are seen on the patch, and it is then seen also that the opacity just bordering the cracks is whiter than elsewhere. The entire stripe is situated rather below the horizontal diameter of the cornea, and inclined from within outwards and a little downwards. In the *L.* eye the upper part of the pupil is still uncovered. *Sight: R.* eye counts fingers at 12″; *L.* reads Jager 6 fairly at same distance with + $\frac{1}{12}$.

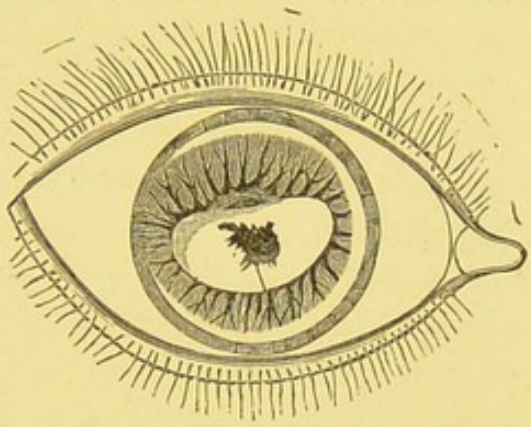


FIG. 1.

No definite complications. Pupils small and very active; the *R.* never dilated widely to atropine though there was no trace of iritis. Tn. in each. The tenderness and ciliary congestion of the *L.* eye soon passed off under local treatment and the administration of some iodide and colchicum. Well-marked arcus senilis.

Treatment of the opacity. In *R.* eye the central part of the opacity was scraped off in two sittings and sight raised thereby from counting fingers to reading Jager 10 fairly well at 12″ with + $\frac{1}{12}$, (it was now found that there was some cortical cataract). In the *L.* eye dilute nitric acid was applied, with the point of a camel's hair brush, several times to the centre of the opacity, a carbonate of soda solution being applied almost immediately after each touch with the acid brush. The acid brush, while in contact, caused brisk effervescence and considerable smarting. The color of the spot acted on changed from brownish to white; it did not clear afterwards, but no harm was done.

I examined the scrapings from the *R.* cornea with results which were in close agreement with the published accounts by Mr. Dixon

and Mr. Bowman. The material consisted, besides portions of healthy epithelium, of small white thin chips. These were formed by a layer, or rather several layers, of small highly refracting granules, sometimes in the form of short thick rods, but often seen endwise, and then appearing to be round ; some were almost dumb-bell shaped. The granules dissolved quickly with effervescence in weak nitric acid, and slowly, without bubbles, in tartaric acid (exactly as in Mr. Bowman's case). After the action of the acids, the position of each granule was faintly visible as a mark of corresponding size and shape, representing either an organic matrix or a little depression on the epithelium into which the granule had fitted. The granules were arranged in a sort of network, with small irregular meshes and thick walls. In one of the fragments a minute mulberry mass was found, each nodule of which seemed to consist of radiating crystals.

A month after the operation, the eye being quiet, it was noted that the cleared space remained quite free ; but on careful examination the portion of cornea exposed was found to be not perfectly clear, a very finely granular haze being perceptible when magnified.

Four months after operation (January, 1878) the condition was the same ; the space cleared remaining clear and sharply defined (Fig. 1), and the cornea exposed thereby appearing at first sight perfectly transparent, but when examined by focal light and a magnifying glass showing a very slight haziness, apparently superficial.

The opacity on the *Left* cornea, which was touched with acid three months ago, looked exactly the same both in color, density and size, as before the acid treatment, and I accordingly scraped off a part opposite the lower part of the pupil, and probably below the spot to which the acid had been applied. It is as yet (January 9th) too soon to tell the effect on sight in this eye.

The chips from this eye presented the same general characters as described in the right eye. In the present specimen, however, it was evident that many, if not most, of the granules had become confluent, and that minute conglomerate masses had so been formed. Here and there also, when the chips were broken up, separate rounded crystals of much larger size were found. The network arrangement was not noticeable in this specimen, probably because the film was too thick. The granules varied in size from mere dots, barely visible under a power of 400 diameters, up-

wards, but the vast majority were of a nearly uniform and intermediate size, about $\frac{1}{7000}''$ or $\frac{1}{8000}''$ in diameter.

March, 1879.—Conditions as at last noted. The cleared patch on each cornea remains as clear as before, indeed, if anything, rather clearer, and the broken borders of the film which surround the clearing are as abrupt and sharp as they were directly after operation. No change has taken place in the size of the patches, nor have any other symptoms occurred except occasional irritability of the eyes. Sight as before.

Case 2.—Sarah Lasseter, unmarried, a needle woman in comfortable circumstances. Since the age of 12 months her *L.* lower limb has been paralysed and is now wasted. At about 25 she rather quickly lost all her scalp hair and has ever since worn a wig; the eyebrows are thin but not altogether wanting; the eyelashes are good. She was about the middle child in a family of eleven; two brothers and a sister died of "decline," and several others died young. Mother died of cancer on the breast. Father suffered severely from gout in his feet; one niece of the patient is known to have had rheumatic fever. The patient herself has never had a trace of either articular or fascial rheumatism, nor of gout, and is not liable to deposit of lithates in her urine. She is pale and nervous. Teeth large and for the most part sound. She prespires very freely from slight exertion.

At about æt. 27, (two years or so after the alopecia) she began to be liable to relapsing iritis, the attacks being attended with great pain. They occurred at intervals till she was about 40, and then ceased, both eyes being affected, but sight not being materially damaged, so that she was still able to make her living as before. At about the age of 40 she began to use a pink ointment for her eyes, putting it inside the lids as well as to the eyelashes, and using it on and off until I saw her. Her reason for using it was that it "cleared the sight," though as above stated she was at all times able to do her work. I do not attach any importance to this ointment in the history of the case, but mention it because such things have been supposed by some to account for the disease under notice.

She dated the definite failure of sight from about æt. 49 (three years before admission), and had found the dimness increasing still more quickly for the last four or five months. She would not admit that the eyes had ever been irritable or weak since the ces-

sation of the iritic attacks. There was nothing in the history to show whether the opacity began sooner on one eye than the other.

Æt. 52 admitted (September, 1877). Conditions symmetrical. A narrow oval of grayish brown superficial opacity, covered by healthy epithelium across the cornea. It is nearly, but not quite, horizontal, sloping rather downwards as well as outwards, and as a whole is situated below the horizontal diameter of the cornea. Each end of the stripe stops considerably short of the corneal margin; the inner end is broader than the outer; the lower border sharply defined, the upper border rather shaded off. In certain lights the opacity is slightly iridescent like the phosphatic film on urine, when magnified it looks like fine sand beneath the epithelium. It is slightly larger on the *R.* eye than on the *L.* In both eyes, old, white iritic adhesions; most in the *L.*, where they allow very little dilation by atropine, but in the *R.* the pupil dilates enough for ophthalmoscopic examination, and the fundus appears healthy. (In the *L.* also after operation the fundus was visible and healthy.) Sight, Jaeger 8 with each eye, but better with the *R.*; she saw better by shading her eyes.

Treatment in each: The central part of the opacity was scraped off and an artificial pupil made downwards and inwards, at separate sittings. Irritability, lasting for some weeks, followed the operations. When discharged six weeks after, the eyes were nearly quiet but sight just as before, not improved; and she still preferred to shade her eyes when reading. I have seen her several times since and found the condition of the corneæ always the same. She considers that the operations have made her sight worse. The microscopical and chemical characters of the particles in this case were almost identical with those of Case 1, and need not therefore be repeated. But a few additional points were noticed; thus when examined in water the regularity with which the granules were arranged was very striking. They were found to be almost all either rod or dumb-bell shaped. After the majority of the smaller granules had been dissolved by a few seconds' immersion in weak tartaric acid, a moderate number of larger rods and a few larger globules were seen. The film in this specimen was thinner and the granules on the average smaller, than in Case 1.

Case 3.—Samuel Spiers (Mr. Hutchinson's patient at Moorfields), steel and copper engraver; uses only graving tools, no

acids. He has slight chronic rheumatism but no gout, nor, so far as his meagre knowledge goes, does there appear to be any gout in the family. A lean man, with nearly white hair, the only survivor of his father's children, æt. about 43. The *L.* eye began to get dim. It was the eye which, with a magnifying glass, he used for his work. After some years the dimness increased so much that he was obliged to change over to the *R.* eye.

Æt. about 61, *R.* eye began to fail. No material pain or irritability in either eye at any time.

Æt. 64, admitted (1873). *L.* eye shows an oval patch of grayish opacity across the cornea, but not reaching quite to the border of either end ; the lower border of the patch curved downwards and exactly fitting to the border of the lower lid when he looks at a new object ; upper border less curved. Epithelium smooth and bright. Some densely white dots visible in the opacity when magnified.

The *R.* cornea shows a similar patch but confined to the inner part ; it begins a little within the corneal border, to which its inner boundary runs parallel, and extends in an oblong form towards the centre, partly covering the pupil. The opacity is most dense at its nasal end and thins away rather gradually over the pupil. Uses this eye for his work.

No complications. Pupils act fully to atropine, and there is no trace of iritis. Tension normal. A considerable *arcus senilis* above and below, but not extending to the sides, so that at the sides a narrow border of *clear* cornea separates the sclero-corneal junction from the commencement of that transverse opacity. Advised to have the opacity in the *L.* eye scraped, but was prevented by illness (bronchitis and feeble health) from attending regularly, and nothing was done.

Æt. 68 (Oct., 1877). The opacity on the *L.* has not increased. In the *R.* it has extended a very little, but still leaves part of the pupil uncovered, and there is no patch on the outer part. With his $+\frac{1}{10}$ can manage to read Jaeger 6 or 8 at about 12″. Is infirm, but intelligent and cheerful.

CASE 4.—*Transverse superficial opacity of apparently similar character on one eye only. Duration uncertain. Failure of sight in both eyes from choroidal disease at yellow-spot regions. Incipient cataracts. Disease of vitreous. No iritis. Health history incomplete.*

Wm. Warwick, shoemaker, came to Moorfields in August, 1877, for failure of sight in both eyes of about eighteen months' duration. He was 78 years old, in good health, hair nearly white, had lost most of his teeth, intelligent and cheerful. Vision=only 20 Jaeger with difficulty with each eye. Pupils fairly active, but neither of them quite round; *R.* rather larger than *L.*; they dilated well to atrophine.

The corneal disease is limited to the *R.* eye; there is no trace of it in the *L.*

In the *R.* there is a sole-shaped band of brownish-gray opacity nearly transverse, but sloping downwards from within outwards, and occupying the central region of the cornea; its two ends lie considerably within the border of the cornea. It is densest at the centre, and shades off rather gradually at its borders, which are nowhere sharply defined. When magnified it looks somewhat stippled. The epithelium covering the opacity is smooth and bright. The patient said that in former years this eye had been liable to be watery and weak, but no other facts transpired to throw light on the want of symmetry.

There were other important changes in *both* eyes to which the failure of sight was due. In each there was incipient cortical cataract, in the form of short striæ with some dots and specks; this was rather more advanced in the eye with the corneal opacity. There was a large area of superficial disease of choroid at the yellow-spot region in each eye, consisting in disturbance of the pigment epithelium, its removal from numerous small spots and accumulation in little dots, lines, etc., in the intervals. No choroidal disease elsewhere, except a narrow belt of partial atrophy around the disk. Disks had a rather brownish tinge, but were not hazy; retinal vessels of normal size. In the *L.* eye (in which the cornea is clear) a large, glistening, tendinous-looking opacity in the vitreous, directly in the line of the disk and rather far forwards. The corneal opacity in the *R.* prevented so detailed an ophthalmoscopic examination in it as in the *L.* Refraction emmetropic.

I saw the patient only once, and made no enquiries as to his constitutional tendencies.

Case 5.—James Broadbridge, a small rather plump-featured old man, now aged 77; was formerly a bath proprietor but failed, and of late years has not been in such comfortable circumstances;

now does a little gardening. Considers that he has had good health. Has healthy grown-up children. No history or evidence of gout whatever in the patient, nor so far as he knows in his relatives. Has always been very moderate, even abstemious, in food and drink. He has always perspired very freely. Believes he does not sleep with his eyelids open. History of onset of corneal disease somewhat indefinite, but he believes his sight to have been perfect till about æt. 65, when it began to get dim. At about æt. 71 or 72 he had a slight attack of inflammation in the *L.* eye, for which he was treated by a chemist and was soon well; he describes some redness, and especially grittiness, "as if he had got some dirt" into the eye. This was the only attack of definite symptoms of which he had any recollection, and the *R.* eye did not suffer at all from such symptoms.

At æt. 73 (Nov., 1873), a year or more after the above occurrence, he came to Mr. Hutchinson at Moorfields on account of the slight impediment to vision caused by the opacities, and has attended occasionally since then. The only treatment has been a zinc lotion. A few weeks ago I saw him for the first time amongst the old cases, and Mr. Hutchinson was kind enough to let me take the case.

Present condition (Jan., 1878). Vision, with $+\frac{1}{10}$; *R.* eye reads Jaeger 4, *L.* eye 6 or 8 J.; with both together he makes out 2 J. The opacities are symmetrical but larger in the *L.* On each cornea are two patches which join one another by a narrow bridge below the pupil. In the right eye the *general* outline of the united patches is that of an oblong out of whose upper part a large piece has been taken. The inner patch, or inner part of the imperfect oblong, is by far the larger, the outer patch (or part) being in fact only comparatively narrow and crescentic. The inner patch covers about a quarter of the pupil; at this part the opacity is thinned off somewhat gradually, but everywhere else its outline is sharply defined. Several cracks, all of them bordered by white, are seen in different parts and it is noticed that they all run almost radially in respect to the centre of the cornea; one crack leads up to a small patch from which the film has separated. There are also several white radial marks without central cracks. The patch is covered by epithelium; but contrary to rule this is not perfectly smooth, but shows a considerable number of minute rounded elevations or hillocks looking like vesicles or semi-transparent beads, but not looking chalky. The patches on

the left cornea are modified, probably by ulceration occurring on their surface at the date of the inflammatory attack which has been described. They are larger, more densely opaque and much whiter, and present considerable irregularity (a sort of facetting) of the surface. The inner patch is continuous with the scleral border and several straggling vessels pass on to it for a considerable distance. When carefully examined the presence of the film can easily be detected, especially on the outer patch; and it can be seen to be broken up into distinct pieces separated by wide cracks, like broken ice. The corneal tissue beneath, however, is hazy, and thus the characters of the superficial film are less made out. Tn. Pupils round and active. Well-marked arcus senilis. Arteries not rigid.

In this disease the opacity may begin either as a single patch at the centre or at one side, or as two separate patches, one at either end of a nearly transverse diameter. When it begins centrally (as in Cases 1 and 2) the opacity spreads almost horizontally towards the margin, remaining widest at the centre; when it begins at the sides of the cornea (as in Case 5) the patches approach one another, and often coalesce more or less fully over the centre of the cornea, the centre of the combined patch remaining its narrowest and least opaque part. The length of the patch or stripe is generally rather more than twice its breadth; sometimes it is widest over the middle, tapering to each end, while in other cases it is widest towards one or other end.

The direction of the stripe is not quite horizontal, for it always slopes a little from within outwards and downwards. The larger part of the opacity is below the horizontal diameter of the cornea, and thus the lower or lower-inner half of the pupil is the first part to be covered. When the eyes are directed to some near object, as in ordinarily downward convergence, and the eyelids partly closed, the borders of the opaque stripe usually correspond with great accuracy to the edges of the lids. The opacity often comes nearer to the inner than to the outer border of the cornea (Fig. 1). The lower boundary of the stripe curves downwards, and is often more sharply defined than the upper, which is also as a rule less curved. The upper-outer part of the pupil is the last

to be eclipsed by the spread of the opacity. The change progresses with extreme slowness, and several years often pass before the patch, even if it be central, causes much inconvenience. (There is, however, reason to suspect that in some cases it rather quickly reaches to a certain stage and then stops, or advances very slowly; on this point more information is wanted.) When fully formed it is equally opaque in all parts, but in younger specimens the newest parts of the patch allow some light to pass through. In no case has this change been seen in the parts of the cornea habitually covered by the lids, though in several cases, (Nos. 7, 11, 13, 14, 17, 18) many years, and in Case 3 as long as 20 years, had passed since the symptoms began.

The opacity never reaches quite up to the corneal border, not even when it begins by lateral patches; and a narrow rim of clear cornea may be seen bounding each end of the stripe even in the oldest cases (No. 3). It may be noted that this clear border is just the part affected by arcus senilis when complete (see Fig. 1), and is the part most under the influence of the conjunctival vessels. The opacity is of a light brownish or gray color, never white; it looks, in fact, like rather dirty ground-glass viewed from the *unground* side. Examined with a hand-lens it is minutely granular like fine sand, whilst scattered blackish dots, or white, chalky-looking specks, or fine, rather sinuous dark lines, may sometimes be seen. The dark lines are cracks in the brittle lamina through which the dark iris or pupil is seen. Mr. Dixon compares them to cracks on old varnish—just as cracks in the enamel of a teacup are edged by a border of slight staining, so the cracks in this calcareous film are edged by a narrow border of whiter color than the rest. Sometimes the opacity is slightly iridescent, like oil on water, or phosphates on urine. The disease may co-exist with *arcus senilis*.

If the epithelium is scraped off we come down to a hard, gritty layer, which, with a little pains, can be picked or tilted off in small chips, as one takes off bits of shell from an egg. The cornea beneath this crust is transparent, and if the patch so cleared be opposite to a clear pupil, good sight will

be restored as soon as the corneal epithelium has reformed. The little chips become white when dry. They were found by Mr. Bowman (Case 7) to consist microscopically of small, "rounded, highly refracting grains," closely aggregated and forming a sort of network with very thick and close meshes. The late eminent chemist, Professor Miller, of King's College, found that these granules consisted of "the same ingredients of ordinary bone, *viz.*, phosphates of lime and magnesia, with a considerable proportion of carbonate of lime;" he tested for lead, but found no trace of it. The epithelial cells in this case were quite healthy.

In Mr. Dixon's case (Case 6) the scrapings were examined by Professor Taylor, and found to consist of phosphate and carbonate of lime (in a later account of the same case Mr. Dixon says phosphate and *sulphate* of lime, but this is probably an error).

The *sensibility of the cornea* at the seat of disease is certainly not abolished, even if at all lowered. In Bowman's case the man fainted with the pain of scraping; in my own cases the operation gave quite as much pain as commonly attends the removal of a foreign body, and although in one of them I thought the surface over the opacity, before the operation was begun, less sensitive than the clear part of the same cornea, I do not feel sure that the observation was reliable.

The only important symptom in uncomplicated cases is a slowly increasing dimness of sight, commensurate with the size and position of the opacity. When the opacity begins at the centre, the patient's complaint is often the same as in early nuclear cataract, *viz.*, that he sees best in a dull light or when he shades his eyes. As has been mentioned, irritability and watering are sometimes present, but seem to be just as often absent. In an important contingent of the cases glaucoma, or iritis leading to secondary glaucoma and cataract, are found, one or other of these results being present in 7 of the 20 cases which form the basis of this paper.

The disease is so rare, and so large a number of its subjects are tolerably advanced in life when it begins,

that although curative treatment by operation is a matter of some importance for the ophthalmic surgeon, the questions relating to its cause have a much greater and more general interest. In cases where the corneal film is the only disease, and where sight is considerably impaired, the opacity should be chipped off opposite the pupil by a combination of lifting and scraping with a broad needle or a small, blunt-ended knife, such as was formerly used for enlarging the opening in the flap operation for cataract. In complicated cases iridectomy will generally be necessary, and Arlt maintains that he has extracted the opaque lens in some cases with good result.

So far as is known there seems to be no tendency for the film to form again over any part from which it has been chipped away. In Case 1 a year and a half, in Case 6 a year, and in Case 7 three years and a half are known to have elapsed without any fresh deposit on the cleared area.

In examining as to the *cause of this disease*, we must take such separate factors as seem likely to furnish information.

1. *Symmetry.*—Both eyes were affected in 14 of the 16 cases where this point is mentioned. In one of the exceptional cases (Case 4) the duration of the disease on the one eye was uncertain; in the other (Case 16) three and a half years had elapsed without the second cornea suffering. But an interval quite as long as, and sometimes much longer than, this, elapsed between the onset of the disease in the two eyes in several cases (Cases 1, 11 and 3), so that no positive conclusive inference of its even occasional asymmetry can be drawn from these two cases.

It would seem indeed that the disease always becomes symmetrical. The fact of symmetry, however, does not help us to the determination of a constitutional, as against a local, cause in this malady; since both corneæ would, under ordinary circumstances, be exposed to the same local influences.

2. *Sex* is stated in fifteen, and all except one were males.

The exception occurred in a woman who had had relapsing iritis, and showed other peculiarities.

3. The patients' approximate *age when the opacity began* is given in fourteen cases. In seven of these the patient was over 50; between 45 and 50 in three; between 30 and 45 in two; and below 30 in only one. The cases beginning early were No. 3 at about æt. 43; No. 14 at æt. 34 or 35, the patient dying at 53 of granular disease of the kidneys; and No. 13 at æt. 25, the patient's father having suffered from gout.

4. The patient's *occupation* is named in only eleven cases. No connection with the disease is traceable, unless trades predisposing to gout may be supposed to have an indirect influence. They are as follows:

Traveller in early life; afterwards coachman (Case 1).
Traveller (Case 12).
House-painter (Case 7).
Barometer-maker, but having very little to do with mercury, and never known to have been affected by it (Case 14).
Water-gilder (Case 13).
Glass-engraver (Case 8).
Steel-and copper-engraver, but using no acids (Case 3).
Bath-keeper and lately gardener (Case 5).
Cabinetmaker (Case 6).
Needlewoman (Case 2).
Shoemaker (Case 4).

5. Facts as to the *constitutional state and morbid tendencies.* Most of the patients appeared in good health when seen. Several of them are particularly stated to be thin, dry-fibred and sallow (Nos. 1, 2, 3 and 13). Only one is said to be plethoric (No. 12). There was a history of consumption in the family in Cases 2 and 14. There was a perfectly definite *history of gout*, either in the patient or his father, in four cases (Nos. 1, 2, 12 and 13); and one other patient (No. 7), though not stated to be gouty, was a painter. In

five other cases (Nos. 11, 15, 15, 18, 20), though little or nothing is mentioned as to the patient's health, there were other changes in the eyes (iritis,—glaucoma,—hemorrhagic retinitis) which are well known to be often closely associated with gout. Case 14 died with granular disease of kidneys, hypertrophy of heart, and pulmonary apoplexy, with widely diffused and abundant atheroma of arteries, at the age of 53; he had never had gout, and the *absence of* gouty changes is particularly mentioned in the post-mortem notes. In the remaining five cases (Nos. 6, 9, 10, 17, 19) there is no information as to general health.

The following facts and queries may be considered *in favor of a local cause* for this disease:

a. It never invades the parts of the cornea which are habitually covered by the lids. It generally increases till the whole of the exposed part is involved and then stops. Small irregular masses of black or brown pigment are often imbedded in the film, probably particles of dust.

b. A margin of cornea at each end of the opacity always remains free.

c. It will be worth while in future to ask whether the patients are in the habit of sleeping with their lids partly open, or whether a somewhat low degree of corneal sensibility allows them to wink less often than other people. Such pecularities would allow a freer evaporation from the cornea, and might therefore lead to an increased flow through the tissue towards the exposed region, and to the collection of any solid residue thereat. Any such tendency would, I suppose, be increased by working in hot rooms, and by habitual exposure to the wind. Such increased transudation through the exposed part need not cause the epithelium to dry, for it would still be moistened by the lids. That the crystalline film forms *beneath* the epithelium and gives rise (except in rare cases) to no change in this structure, seems equally difficult of explanation on any hypothesis; it may, perhaps, be analogous to the formation of crystalline deposits ("Cystoliths") with which I believe botanists are familiar as occuring *just beneath the surface* in some plants.

d. Is it due to a superficial *inflammatory* change leading to calcification? Note the occurrence of ciliary congestion and irritation in some cases.*

The opportunity of making sections of the diseased cornea is much wanted; the names of several of the patients are given in full at the end of this paper, and it is possible that some of them may come into the hands of our Pathological Registers.

e. Can the disease be partly explained by natural differences in the closeness or permeability of the corneal tissue, or in the thickness of its epithelium, in different persons?

In *favor of a constitutional cause: a.* Although this crystalline film forms only a part which is exposed constantly to the air, yet it takes place in so few persons that there must be some special conditions added, not only perhaps as regards unusual exposures of the vulnerable part, as above suggested; but an altered composition of the eye-fluids, and therefore probably of the blood. Such an error of composition might affect either the aqueous humor, or the nutritive fluids of the cornea; and the result might be explained by an excess, or with more likelihood by a wrong composition, of the natural lime-salts of the blood. It is extremely interesting to note in this connection that oxalate of lime is stated by Dr. Garrod to be very abundant both in the blood and *perspiration* of many gouty persons.

b. Its occurrence almost without exception in men.

c. The history of gout in one patient and in the parents of several more, and the occurrence in others of insidious iritis, glaucoma, and hemorrhagic retinitis, maladies which are well known to affect gouty persons, or gouty families, with especial frequency, *seem to point to gout, or perhaps rather to excess of uric acid in the blood*, as supplying the most likely explanation of this very peculiar corneal disease.

d. Is any corresponding (not necessarily identical) change

* It may here be mentioned that cases are sometimes seen in which diffuse inflammation of the central region of the cornea occurs, with steaminess of surface and some haze of the proper corneal tissue. I have never seen such cases excepting in adults; and have one at present under care in a rheumatic man. Such cases need further study. As a rule they are not difficult to distinguish from heredito-syphilitic keratitis.

met with in skin or mucous membrane elsewhere? Note that the cornea supplies the only well-moistened mucous surface which is constantly exposed to the air.

e. Is the disease found in any lower animals? It is of interest to bear in mind that the so-called anterior elastic lamina of the cornea, upon which the film lies, is a much better marked structure in man than in many animals.

f. In what relation does the corneal change stand to iritis and glaucoma when these occur with it? Von Graefe looked upon the corneal disease as forming the first stage of a chronic disorganizing iritis, followed by a secondary glaucoma; and in regard to the cases in which such complications have been found, this would appear to be the general (though not *invariable*) sequence of events. In a few cases *simple* subacute, or chronic, glaucoma follows the formation of the opacity, without the intervention of iritis; a fact of which Graefe was also aware (Cases 15 and 16). The natural history of the disease is as yet very incomplete. It may in the end appear that such an error of composition of the juices of the body as gives rise, under certain local conditions, to the uncomplicated crystalline film, is also an important factor in the etiology of some forms of glaucoma. Certainly the occurrence of chronic iritis and glaucoma in several genuine cases of this sub-epithelial calcareous film, seems to point to a more than accidental relation between the two.

The subject would be incomplete without some notice of certain cases which resemble the present disease in the position of the opacity, and are perhaps similar in some of the pathological processes, though in all probability differing from it essentially in cause. I allude to cases in which the corneæ of eyes which have been long blind, present a broad stripe of superficial opacity running (as in the disease already considered) across from side to side. The opacity in such cases, however, generally involves the epithelium, which, losing its smoothness and polish, becomes steamy or

pitted, or studded with little granular elevations. The opacity is also less uniform in thickness, and less defined in outline than in the true disease; in some specimens, indeed, it is quite irregular, showing many dense spots and other light spaces; it is also of white color. Microscopical sections of such corneæ have shown various changes in the epithelium, with puckering of the anterior elastic lamina, and sometimes changes in the superficial laminæ of the cornea; but I do not know that a film of calcareous particles has been found.

The changes here alluded to are found on the cornea of eyes blinded by many different causes and occur at all ages and in either sex. But it is important to note that in many of them the eye either is at the time, or probably has been, glaucomatous, either spontaneously or from injury; in some there has been cyclitis, while in others the globe is shrunken and plates of bone are found on the inner surface of the choroid. In all of them it is likely that the sensibility of the cornea has been lowered as the result of disease of the ciliary nerve, and that consequent undue exposure may have been the chief agent in bringing about the changes observed.

We must, I think, regard these cases of *roughened transverse opacity in eyes already blind*, as having a very different signification from the *smooth subepithelial incrustation of lime-salts* which forms the subject of this paper.

Goldzieher has lately described the changes in the cornea in a case of this secondary riband-shaped opacity as consisting in colloid formations in the superficial corneal layers, irregular thickening and degeneration of the epithelium and the presence of masses refracting like fat, but resisting ether, situated in the deeper layers of the cornea.—Hirschberg's *Centralbattl*, January, 1879.

LIST OF AUTHORS.

1848. Dixon. Diseases of the Eye, 3d edition, p. 114. (Case observed by Dixon in 1848, and first published by Bowman in his lectures on the Parts concerned in Operations on the Eye, 1849. Reproduced in

Dixon's work.) Case completed in British Med. Jour., 1871, i, 443,

1849. Bowman. Lectures on the Parts concerned in Operations on the Eye, p, 117. A different case from the above. Wood-cuts of the cornea before and after operation, and of the microscopical appearance of the scrapings. Case completed in Med. Times and Gazette, 1852, ii, 264. These seem to be the first two cases on record. They are quoted by many later writers. Bowman's wood-cut is reproduced in the French edition of Mackenzie's Treatise. It is singular that v. Graefe, writing in 1869 on the subject, makes no reference to them.

1852. Bowman. Med. Times and Gazette, ii, 264. A new case. Reported by Hutchinson.

1855. Haynes Walton. Med. Times and Gazette, 1855, ii, 163. A new case. From internal evidence there can be no doubt that this is the same case as Farilie Clarke's Case III in Brit. Med. Journal, 1870, ii, 380.

1869. v. Graefe. Archiv f. Ophthalmologie, xv, 3, 138. The disease considered in relation to glaucoma. Lithographic plate showing four corneæ in different stages from three cases. (Translated, excepting the descriptions of the figures) in Ophth. Hos. Reports, vii, 1.

1870. Fairlie Clarke. Transactions of Path. Soc. of London for 1869–70, p. 331. Two new cases with wood-cuts of the cornea in each.

Fairlie Clarke. Brit. Med. Journal 1870, ii, 380. The above two cases reproduced with the addition of a third new case. (See Haynes Walton, above.)

1871. Arlt. Zehender's Monatsbl. f. Augenheilk., p. 369. The subject in connection with a paper by Leber, on the filtration-power of the cornea.

Arlt, Schweigger, and Saemisch have all seen cases.

1872. G. Obertüschen. Inaugural Dissertation. "Ueber Band-keratitis." Bonn, July 23, pp. 26 Four new cases given with great brevity; two of them had been for some time previously under the notice of Dr. Saemisch.

1873. Landesberg. Archives of Ophthalmologie and Otology, iii, 1, 63. Two new cases.

1853. Haynes Walton. Med. Times and Gazette, 1853, ii, 469.

1855. Haynes Walton. Ibid, 1855, ii, 163. Two cases of somewhat different nature treated by scraping off the opacity.

Cases of transverse corneal opacity forming in eyes already blind have been published by Spencer Watson, (Trans. of Path. Soc., xxii, 255, for 1871); Nettleship, (Ophth. Hosp. Reports, vii, 550 and 558); Brailey, Ibid, viii, 295, ix, 80; and by others.

ABSTRACTS OF RECORDED CASES,

IN THE ORDER OF THEIR PUBLICATION.

The numbering is continued from Case 5 already given in the paper.

By the kindness of Mr. Fairlie Clarke I have been able to follow up the three cases published by him in 1870, and to add some new matter to them (Cases 12, 13, 14).

Case 6.—John Trevelyan, cabinet-maker. Disease appears to have come on with unusual speed, and the opacities to have become fully formed in less than a year.

Admitted. Æt. 58. Transverse stripe of brownish very super-

ficial opacity across cornea entirely hiding pupil and middle third of iris; traversed by a few delicate cracks; widest at middle and tapering towards inner and outer margins; covered by healthy epithelium. Symmetrical.

No complications. Pupils small, but iris quite healthy. No inflammatory symptoms at any time. V. good when objects are held above or below, but he is nearly blind for objects placed opposite the opacity.

Treatment.—Epithelium and sub-epithelial film scraped off. The film chipped off in small flakes which Mr. Taylor found composed of phosphate and carbonate of lime. Corneal tissue beneath film quite clear. V. so much improved that he could see to do his work after operation as well as ever.

A year after operation no trace of fresh deposit on the cleared space.

(Dixon, "Diseases of Eye," 3d edition, p. 114. Oct. 16, 1848. Case completed, *Brit. Med. Jour.*, 1871, i. 443.)

Case 7.—John Kemp, house-painter, healthy constitution Æt. 45. A slight ophthalmia leaving no trace.

Æt. 48. Wife noticed a speck on each eye, but it did not interfere with sight.

Æt. 51. Opacities had increased and now interfered with central V. in strong light.

Æt. 55, (Jan., 1849). Stripe of brownish opacity across cornea, quite hiding pupil and part of iris; finely mottled with dark dots; surface of cornea bright and smooth and epithelium healthy; stripe widest at centre, tapering towards ends, its margins rather abrupt, coming nearer to inner than outer edge of cornea but not reaching either; direction nearly transverse but sloping a little downwards as well as outwards, and its lower border corresponding exactly with border of lower lid when eyes adjusted for near objects. Symmetrical. On one eye it showed a crack at inner end. V. only large objects.

No complications. Iris and pupil perfectly healthy.

Treatment.—Epithelium and film scraped off. Film came off in little chips which whitened when dry, and consisted of highly refracting rounded grains arranged in a close network beneath epithelium. Professor Miller found the chips to consist chiefly of carbonate of lime with some phosphate of lime and phosphate of magnesia. V. after operation improved to 4 or 6 J.

Three years and a half later (Sept., 1852), æt. 58 or 59. "The cleared part in front of the pupil in each eye remains perfectly clear, and the opacity terminates by the sharp edge left by the removal of the central portion of the flaky deposit. He sees to read the smallest type."

(Bowman, "Lectures on Parts concerned in Operations on the Eye," p. 117, with wood-cut of cornea and of microscopical structure of the deposit. Jan., 1849. Case completed, *Med. Times and Gaz.*, 1852, ii, p. 264.)

Case 8.—John I. Lee, formerly a glass-engraver, a hale old man.

Æt 73. Sight began to get cloudy; after a time became unable to see things straight before him but could see upwards and downwards.

Æt. 78, (1852). Elliptical band of light brownish opacity horizontally across cornea; broadest at centre and quite hiding the pupil; appears granular. V. only shadows. Symmetrical.

No complications; iris and pupil quite healthy.

Treatment—Epithelium and film scraped off; film came away in little scales; subjacent cornea perfectly clear. A few days later could see small objects such as pins quite well.

(Bowman, *Med. Times & Gazette*, 1852, ii, p. 264. Reported by Hutchinson.)

Case 9.—v. Graefe's paper, (Fig. 1). Representation of *L.* eye. Two semi-opaque brownish yellow patches at inner and outer part of cornea rather below horizontal diameter; upper border straight; lower, curved downwards corresponding to border of lower lid; central part of cornea unaffected. The patches begin just within the border of the cornea and are most dense there.

Treatment.—Iridectomy downwards: eight days after it V.=¾; no note of previous V.

(v. Graefe, *Archiv. f. Ophth.*, xv, iii, p. 145 and Plate 1, 1869.)

Case 10, (Ibid., Fig. 2). Representation of *R.* eye. Two patches passing from inner and outer part of cornea towards middle but not quite meeting; centre clear; the opacities as a whole nearly transverse, abruptly margined, upper border nearly straight, lower rather curved downwards; most dense near edge of cornea; a narrow rim of clear cornea separates the outer border of the opacities from the boundary of the sclerotic.

Pupil round and iris clear. Tension not noted. Disease in an early stage.

Case 11.—(Ibid. Figs. 3 and 4), *R.* and *L.* eyes of the same patient.

Fig. 3. *R. eye:* Complete transverse band of opacity rather below horizontal diameter; upper border nearly straight, lower slightly curved downwards; nearly of equal width at all parts; margins everywhere abrupt; narrow rim of clear cornea between the ends of the opacity and the border of the sclerotic; a small part of the undilated pupil remains uncovered; the band appears formed by coalescence of two separate ones such as shown in Figs. 1 and 2. Duration 8 years.

Complications: Extensive iritic adhesions and muddy iris. T. increased.

Treatment.—Iridectomy has been done upwards.

Fig. 4. *L. eye;* patch of opacity extending from near outer margin to centre, but none on inner part; less uniform than in most cases and shows numerous calcareous spots (some were examined). Duration, 12 years.

Complications: Total posterior synechia; iris degenerated; T. much increased; no perception of light.

Case 12.—John Woodfield, traveller; hale, ruddy, healthy looking, but latterly nervous and liable to giddiness. Perhaps had syphilis about æt. 25. No examination. Father was "a martyr to gout," but patient had not had it.

Æt. 53, dimness of sight first noticed; gradually increased.

Æt. 55 (1877). Stripe of rusty brown opacity across cornea nearly horizontal but sloping a little downwards as well as a little outwards; edges slightly shaded off; overlying epithelium smooth and not raised. Symmetrical but larger in *L.*

No complications; pupils dilated well to atropine; ophthalmoscopic appearances healthy. Neither pain nor inflammatory symptoms at any time. No operative treatment.

Patient died about three years later; no details obtained (note from wife, Nov. 1877, E.N.)

(Fairlie Clarke, *Brit. Med. Jour.*, 1870, ii, 380, Case 1.)

Case 13.—George Hill, water-gilder; pale, thin, delicate looking, light hair, gray irides; no history of gout, rheumatism or syphilis in patient; but his father (also water-gilder) suffered

much from gout in feet, hands and knees. Patient is fifth in family of thirteen, of whom nine died in early life.

Æt. 25. "A cloud began to come before his sight."

Æt. 35. So bad that he could no longer see to work.

Æt. 40 (1870). Admitted. Oval patch 4 inches by 2 of rusty brown opacity horizontally across cornea corresponding to palpebral tissue, widest at middle, tapering to each end but more so inwards than outwards; inner end reaches nearer than outer end to border of cornea; outer end bifurcated or notched in *L.*, not so in *R.*; uniformly dense throughout, edges slightly softened, epithelium smooth and healthy. Symmetrical. V. 10 J. with each eye at 6″.

No complications; pupils dilated well to atropine; ophthalmoscopic appearances healthy. No pain or inflammatory symptoms of any kind throughout.

No operative treatment.

Æt. 48 (Nov. 1877). (Seen again and family history completed as above E. N.) V. somewhat worse; now just sees 12 J. when he has his back to the window and looks between his fingers; cannot see to do his work. Upper and lower part of each cornea quite clear. Pupils very active. Tension N. Of late the eyes have occasionally been irritable. Operation (scraping) advised but declined. (Fairlie Clarke, *Brit. Med. Jour.*, 1870, ii, p. 380, Case 2; also *Trans. of Path. Soc.*, of London for 1870, p 331, Case 2, with wood cut.)

Case 14.—Thomas Pritchard, barometer-maker, but having very little to do with mercury; no history of gout, rheumatism or syphilis; no gout known in the family, two brothers of patient died of "consumption."

Æt. 34 or 35 The opacity began on *L.* eye.

Æt 38 (1855, came under care of Mr. Haynes Walton). Both eyes affected but *L.* the worse. Atropine by dilating pupils gave tolerable vision.

Attempt made to scrape off a part of opacity on *one* eye *(sic)*, but was ineffectual. The scraping consisted of epithelium with some pigment.

Æt. 50 (1870). Came under care of Mr. Fairlie Clarke. V. considered to have been improving somewhat for last few years. Symmetrical, but disease rather worse in *L.*

Oval gray-brown patch of opacity, horizontal and correspond-

ing to palpebral fissure, widest at centre and tapering to each end, not reaching border of cornea at either end, size, 5 lines by 3; margins sharply defined. In each the opacity is incomplete at centre where a patch of cornea over centre of pupil remains clear; this space is largest in *R.* where it communicates through an opening in the upper part of the opacity with the clear cornea beyond. Surface smooth and epithelium healthy. V. of *R.* 4 J. at 6″, of *L.* 10 J. at 6″.

Æt. 52. Had an attack of erysipelas of face.

Æt. 53. (May, 1872). Went to St. Thomas Hospital with albuminuria. Died suddenly a few days after admission. *P. M.* Pulmonary apoplexy. "Arterial branches through the whole of both lungs were atheromatous, *i. e.* opaque yellow and thickened." Considerable amount of fluid in both pleuræ but no notable adhesions. A small old calcareous nodule in apex of *L.* lung. Great enlargement and hypertrophy of all the walls of the heart (20½ oz.); endocardium thick, white and opaque. Valves competent. Moderate atheroma of aorta but no calcareous plates. Liver hard, somewhat nodulated, weight slightly diminished. Spleen small and hard. Kidneys small, hard, granular surface, very tough, cortex wasted, arteries rigid, with intense venous congestion. "No blue line on the gums; no sign of gout." Double hydrocele. (From record of post-mortem made by Dr. Payne.) (Haynes Walton, *Med. Times and Gazette*, 1855, ii, p. 163. Fairlie Clarke *Brit. Med. Jour.*, 1870, ii, p. 380, Case 3; and *Trans. Path. Soc.* of London for 1870, p. 331, Case 1, with wood engraving. Family history completed from son's account 1877; I have also to thank Dr. Greenfield for allowing me to examine and use the post-mortem record, E. N.)

In this case Mr. Fairlie Clarke thought the central clear space in each eye due to spontaneous chipping away of the film. This is the only case in which such a process has been suggested by the existence of a clear but irregular and abrupt space, such as is figured by Mr. Clarke. The appearances are just like the result of a successful scraping operation. Although Mr. Haynes Walton is stated to have operated unsuccessfully and on only one eye, it is possible that some error may have crept into his account of the case, or that the film was loosened and afterwards came away.

Case 15.—A man, æt. 58. Symptoms began in *R.* In about eighteen months opacity had covered transverse part of cornea;

not stated whether it began at centre or at sides. Came under care æt. 60 (November, 1868), with transverse opacity, reddish brown at sides, whitish at middle; eye irritable and dazzled. Three months later, glaucoma. Iridectomy followed by improvement of sight. Three years later (at 63), no glaucomatous symptoms, but stripe of opacity considerably wider.

L. eye began to suffer a year or more after *R.*; began as two lateral patches, and progressed slower than *R.* When first seen at 60 (November, 1868), patch of opacity on each side opposite palpebral fissure. Three years later, patches somewhat larger, but not yet met at centre; no irritation at anytime; no glaucomatous symptoms; fundus healthy; refraction hypermetropic $\frac{1}{24}$; sight normal.—(Landesberg, ARCHIVES OF OPHTHALMOLOGY AND OTOLOGY, iii, 1, p. 63, 18).

CASE 16.—A man, strongly built and healthy-looking. No note as to gout, but note the presence of *numerous peripheral* retinal hemorrhages, such as are often associated with gout (Hutchinson).

Æt. 53. *R.* eye began to tire more easily than *L.*; then V. began to fail, and eye became subject to "dazzling." Four months before admission pain and symptoms of glaucoma.

Æt. 55. Admitted. Only *R.* affected. Incomplete stripe of brownish opacity across horizontal diameter of cornea, centre remaining clear; surface smooth. Subacute glaucoma, with numerous retinal hemorrhages at lower part of periphery, and some at inner part nearer disk; myopia $\frac{1}{6}$.

Treatment.—Iridectomy. Sixteen months later good result, with no relapse of glaucoma, and no increase of opacity; retinal hemorrhages absorbed.

L. eye, myopia $\frac{1}{8}$, and no trace of disease at date of last note. —(Landesberg, Ibid., Case 2.)

CASE 17.—G. S., a man. Æt. about 44, dimness of sight began; does not know whether one eye preceded other.

Æt. 54. Opacity of central part of cornea, densest at middle, and sends out less dense streaks, especially towards lower-inner part; numerous very fine dots visible by focal light. Symmetrical, but denser in *R.*, where it is brownish yellow; in *L.* it is of dull-gray color. Can still see tolerably well. He has been under the notice of Dr. Saemisch at intervals for nearly ten years, and the opacity has in that time increased both in size and density.

No complications; visual field good. Tension normal. Myopia ⅓ in *R.*, V.=8 J.; myopia ⅛ in *L.*, V.=1 J., but not easily. Large posterior staphyloma in each.—(Obertüschen *Inaugural Dissertation:* Ueber Band-Keratitis, Bonn, July 23, 1872.)

Case 18.—I. D., a man. Æt. about 45 the disease began.

Æt. 71 fully developed band of opacity on cornea, nearly horizontal but sloping outwards and rather downwards, and corresponding exactly with the half-opened palpebral fissure, equally dense all over. Remainder of cornea clear excepting *arcus senilis.* Symmetrical. V. only shadows.

Complications: Lens calcified and iris muddy; iridectomy upwards has been done in both eyes. Visual field and tension normal.—(Ibid., Case 2.)

Case 19.—A patient with well-defined band-shaped opacity corresponding to the half-opened palpebral fissure. Myopia ⅙ and sharply defined posterior staphyloma. Tension normal. Not stated whether one or both eyes affected.—(Ibid., Case 3.)

Case 20.—A patient with central opacity as yet but slightly developed, but "showing a tendency to progress towards the edge." Not stated whether one or both eyes affected; but both have been glaucomatous for a long time.—(Ibid., Case 4.)

The two following cases are probably of a different nature, but they illustrate the successful result of mechanical removal of the opacity:

Case 21.—A man; had some lime thrown into one eye. Was treated promptly, but dense opacity remained.

Four years later (æt. about 50), dense white opacity covering nearly two-thirds of cornea, and quite concealing the ordinary pupil; smooth and uniformly covered by epithelium; surface "appeared" slightly elevated.

Treatment.—Opacity removed with a small iris-knife; after removal of epithelium the opacity "chipped off in small flakes," which, chemically tested, were found to consist of carbonate of lime,

V. restored almost perfectly.—(Haynes Walton, *Medical Times and Gazette*, 1855, ii, p. 163.)

Case 22.—Elizabeth Wheeler; no facts of general interest to be gained from the history.

Subject to inflammation of eyes from childhood, and V. as bad as on admission for about ten years.

Æt. 29 admitted. Conditions symmetrical, but worse in *L.* Central, large, densely opaque, sharply-defined patch of French-white color on cornea; "slightly raised;" irregularly circular. There were dots or mottlings on the patch. The pupil quite concealed. Rest of cornea transparent.

Eyes seemed otherwise healthy; pupils dilated.

Treatment.—Repeated scrapings with minute gouge restored V. of both eyes to such a degree that she could thread a common sewing needle. Treatment extended over more than a year. She is stated to have been practically blind for the previous ten years.

Opacity did not feel gritty; no note of chemical or microscopical examination.—(Haynes Walton, *Med. Times and Gazette*, 1853, ii, 469.)