

on this hint, the present writer has been in the habit of applying the eserine an hour before the operation. At the time of its performance there is then found a considerable contraction of the pupil, which does not in the least interfere with extraction, and which yields when the anterior chamber is re-established. It then exerts on the iris a degree of traction that reduces to a minimum the danger of its healing into the corners of the wound, and would even seem to render this complication less frequent than formerly. This contraction of the pupil readily yields to atropine, should it be found necessary to employ it during the after-treatment. Eserin. salicylat., rubbed up with vaseline in the strength of one per cent., will be found a convenient preparation to use on account of its being less affected by time than the ordinary solution. The application of eserine is sometimes followed by slight temporary pain, and is hence contraindicated at the time of the operation. Its use has been objected to on the ground that the tendency to a loss of vitreous might be increased, but this theory has been proved unfounded.

The advantages of operating on senile cataract in an establishment especially arranged for the purpose have

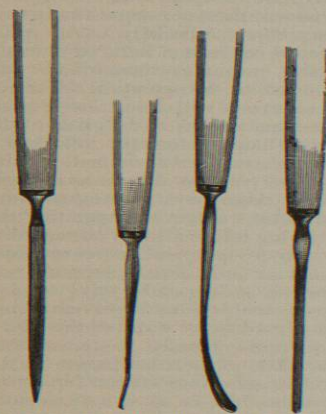


FIG. 1157. Graefe Knife. FIG. 1158. Cystitome. FIG. 1159. Rubber Spoon. FIG. 1160. Rubber Spatula.

already been alluded to. Should this course be adopted, it is well to have the patient occupy his room the night before the operation is performed. A certain amount of acquaintance with the bed, the surroundings, and the attendants is thus acquired before the bandage that prevents all use of the eyes for several days has been finally applied. Another advantage is that there may often be met, in the same place, some convalescent who has already passed through the operation, and who can be brought in contact with the intending patient. A few words of encouragement from such an individual will often do more to dispel apprehension and establish confidence than anything coming from the surgeon himself.

If a trained and experienced nurse be present, the services of a professional assistant may readily be dispensed with. The patient awaits the surgeon in bed and undressed. As the bandage to be applied after the operation is monocular, the eye that is not to be touched is closed by several short strips of isinglass plaster, crossing each other. A short preliminary drill in turning the eye in any given direction, without any corresponding movement of the head, will be found of much use; the patient being directed to roll the eye up, down, or to either side at the request of the operator; being also cautioned, the while, to avoid straining, and to breathe easily and naturally. In the case of very deaf people it is well to arrange a little code of signals in advance, a tap on the forehead being understood to mean a direction to look up, one on the chin to look down. Under ordinary circumstances the duty of the nurse is confined to handing the iced sponges as they are needed, and supporting the head while the bandage is being applied.

**PERIPHERIC LINEAR EXTRACTION.**—This is commonly known as the method of von Graefe. The instruments needed are a spring speculum, fixation forceps, elevator, Graefe extraction knife (Fig. 1158), cystitome and rubber spoon (Figs. 1158 and 1159), Daviel spoon, iris forceps and scissors, and a small, straight, flexible rubber spatula (Fig.

1160). A few soft compresses, floating in ice water, are also required, as well as corrosive cotton bandages, etc.

The surgeon stands at the head of the bed, and should be able to operate on the right eye with the right hand, on the left with the left. Local anesthesia having been fully brought about, he introduces the spring speculum and locks it in place, being careful not to stretch the lids to a distressing extent. Requesting the patient to look up, he firmly grasps the eye with the fixation forceps, a little below the cornea. Holding the knife with its edge up, he now proceeds to make the cut. The accomplishment of this is not without its difficulties, and demands a careful description. It can best be understood by reference to the following diagram (Fig. 1161), taken from Arlt.<sup>12</sup> The knife is entered, with its blade up, at the point *a*, 1.5 mm. from the corneal edge, and 2 mm. below a tangent to the upper corneal periphery on the temporal side, and directed at first toward the point *b*, situated downward and inward from the pupil. Having been carried steadily forward some 6 to 8 mm. in the direction of this point, the handle is lowered, the point of the knife directed to that of counter-puncture *c*, pushed forward, and made to emerge at this place. The wound to be inflicted will thus be some 12 mm. in length. It is better now to remove the fixation forceps, thus avoiding the danger of undue pressure, and to request the patient to look down. The wound is completed by a sawing movement of the knife, alternately advancing and withdrawing it a little, directing its cutting edge toward the point at or just behind the upper corneal edge, where it is intended that it should emerge (Fig. 1162). No attempt should be made to divide the conjunctiva until the scleral cut is complete. The blade of the knife may then still be directed upward, but a little outward, and a conjunctival flap formed some 2 or 3 mm. in height. Raising the handle of the knife abruptly, from the temple, is advised by Arlt as facilitating this. It will be seen that this is not strictly a linear wound, as originally intended by von Graefe, so that the title of the operation is, to some extent, a misnomer. But the conjunctival flap can be formed only when the cut is made as above described, and the advantages of this flap as a protection to the scleral wound are at once evident.

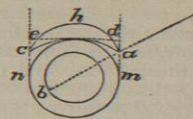


FIG. 1161.—Ideal Periphtric Linear Cut. (Corneal diameter 12 mm.) *a, m, c, n*, tangents to the horizontal diameter *m n*; *d, e*, tangent to the vertical diameter; *a*, point of puncture; *a, b*, line of direction of back of knife at time of puncture; *c*, point of counter-puncture; *a, d, h, e, e*, course of conjunctival wound; *a, c*, course of cornea-scleral wound on outer surface of sclera.

A curved cut is, moreover, longer than a linear one. The external cut being 12 mm. in length the inner one would measure from 9 to 10 mm., and as the diameter of the lens rarely exceeds 9 mm., there is sufficient room for its emergence. Should there be considerable hemorrhage from the conjunctival flap or the scleral wound, filling the anterior chamber and obscuring the view of the iris, it is better temporarily to remove the speculum and hold soft iced compresses in gentle contact with the closed lids. In a few minutes the bleeding will cease, the eye can be again opened, the speculum reinserted, and the coagulated blood removed with iris forceps. Ordinarily, however, we proceed directly to the second step in the operation, the iridectomy.

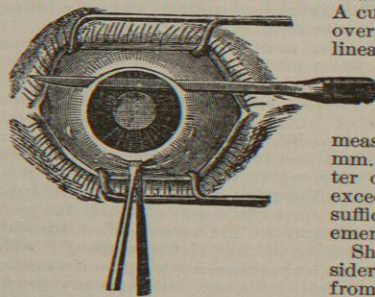


FIG. 1162.—(From Michel's "Lehrbuch.")

scuring the view of the iris, it is better temporarily to remove the speculum and hold soft iced compresses in gentle contact with the closed lids. In a few minutes the bleeding will cease, the eye can be again opened, the speculum reinserted, and the coagulated blood removed with iris forceps. Ordinarily, however, we proceed directly to the second step in the operation, the iridectomy.

It is better to accomplish this without resuming fixation. The iris scissors are taken in the right hand, the forceps in the left. The patient being directed to look down, the conjunctival flap is lifted with the forceps and laid backward over the cornea. The iris is now seized at its pupillary edge, the forceps being well carried over toward the end of the wound at the operator's right, withdrawn, lifted forward, and a straight cut, or rather split, made in its tissue from the pupillary to the ciliary edge; it is then drawn over toward the opposite corner of the wound, being divided as it is thus drawn by repeated strokes of the scissors, and the piece finally completely excised by passing the scissors on the other side of the forceps and repeating the first cut from the pupillary edge backward. A coloboma of from 4 to 8 mm. in extent is thus formed. Professor Arlt, whose method of executing the iridectomy is here closely followed, advises strongly against tearing the iris from its ciliary attachment, rather than cutting it as just described. By following the latter course hemorrhage is far less likely to occur. The edges of the coloboma are to converge toward the pupil, and if considerable iris tissue is left in the corners of the wound it is to be separately excised. At this stage it is often advised to replace small prolapses of iris at the wound angles with the rubber spatula; but as the delivery of the lens is almost certain to be followed by their recurrence, it is better to wait until this has taken place and the pupil been cleared. Hemorrhage may now, if at all embarrassing, be controlled in the manner formerly described.

**Opening of the Capsule.**—Careful watch should be kept over the amount of pressure which the spring speculum exerts on the eye. If this organ be unusually prominent, or the straining of the patient excessive, the speculum may be slightly lifted off by the unoccupied hand of the operator; or even removed altogether and an elevator substituted. Fixation, which has been dispensed with since the performance of the first step in the operation, is not again to be employed.

A word, in passing, on this subject. Sufficient stress has hardly ever been laid on the injurious effect on the eye of prolonged fixation. Each grasp of so delicate and sensitive a member with this rude instrument (toothed or serrated forceps) causes ciliary injection and acts as a local bruise, the multiplication of which may well tend to complicate or retard the healing process. Becker's remarks, in this connection, are most instructive. He says: "Seizure of the conjunctiva bulbi, either alone or with the addition of the tendon of the rectus inferior, is ordinarily looked upon with indifference. And yet an appreciable injury is only too often thus inflicted. Though the fixation forceps be used in the most careful manner, the point which they seize becomes for days the seat of a defined redness. If the teeth of the forceps are very sharp, the patient restless, and the conjunctiva fragile, as is often the case with the aged, bleeding follows, and the tissue may even tear." Speaking later of the wrenching given the cornea, ciliary body, and iris, by drawing down the eye after the cut has been completed, he observes: "The more or less perfect manner in which these secondary injuries are avoided goes very far to determine the varying success met with by operators of otherwise equal skill."<sup>13</sup>

The cystitome is introduced flatwise, at one corner of the wound, pushed forward until its extremity comes opposite the lower edge of the pupil, then turned with its cutting edge toward the face of the capsule, and drawn gently upward to the edge of the wound. To secure a free opening it is better to introduce it a second time, apply it at a point on one side of that first selected, and again draw it upward in a line diverging from the previous one. Care should be taken to exert little or no pressure backward, for fear of causing dislocation of the lens. If the eye be deep-set, it will be necessary to bend the stem of the instrument at an angle some 7 mm. from its point. Should the anterior chamber be filled with blood that cannot be cleared away, the cystitome must still be used in the region of the supposed pupil; but it

is well, under such circumstances, to restrict somewhat its excursions.

Arlt prefers, to the ordinary cystitome of von Graefe, a sharp iris hook with a flexible stem. In cases in which the capsule is opaque there is no doubt but that this membrane may be better seized with such an instrument and brought to the edge of the wound, where it can be removed with scissors. The use of the hook demands, however, special dexterity on the part of the operator.

**Delivery of the Lens.**—We come now to one of the most critical portions of the operation, during which the escape of vitreous is most to be dreaded. Should this accident happen in the shape of a sudden gush, it is desirable immediately to close the eye. The withdrawal of the spring speculum takes time, as it has to be first unlocked and then carefully removed from under the two lids separately, and without tilting over the cartilage of the upper lid, a common occurrence. It has, therefore, long been the practice of the writer to remove the speculum before proceeding to the delivery of the lens, and either to raise the upper lid with the forefinger of the left hand or else to lift it by means of a simple elevator, which can be instantly slipped out if occasion demands. To effect the removal of the lens, the patient is first directed to look down and to keep his gaze fixed in this direction. Much difficulty is occasionally experienced in keeping this up, the eye exhibiting a tendency to roll upward. In such cases it may be found advantageous to place one of the patient's hands outside the bedclothes and then request him to look persistently in its direction. It may serve to fix his attention if the nurse smartly taps the hand from time to time. By getting the patient to look down we are able to exert pressure against the eye through the lower lid, and thus to escape the necessity of bringing any instrument in direct contact with the eyeball. The convexity of the Daviel spoon or the back of a large hard-rubber spoon is laid against the outside of the lower lid; pressed gently, at first backward and then upward, and then, if the lens shows a tendency to emerge and the edge presents itself at the wound, used to assist its expulsion by gently rubbing upward. Should the eye roll up, the pressure must, of course, be applied directly to the eyeball. The moment half the lens has passed through the wound, pressure is to be lessened, but not omitted, until the entire crystalline has emerged. If, in spite of judicious pressure, the lens fails to present itself at the wound, or, having presented itself, to advance, the first thing to do is to repeat the opening of the capsule, a delicate and often difficult procedure.

The lens once removed, the lids may be suffered to close and the patient to rest a few moments. Compresses dipped in cold water may be applied to the eye externally and frequently changed. When the eye is again opened, the pupil is to be carefully examined. If lens fragments or coagula occupy its area, they may be expelled by repeating the manœuvre for the removal of the lens, rubbing upward while the patient looks down. They should, however, first be collected in the centre of the pupil by closing the eye and rubbing gently over its convexity, in a circular direction, with the point of the forefinger. If the cloudiness is evidently due to an opaque capsule, it is better to leave it alone and trust for its removal to a secondary operation. Incising it with a cystitome or sharp hook, as is sometimes advised, would lead to an escape forward of vitreous, and might complicate recovery. When the pupil is apparently clear, vision must be tested. If the answers are unsatisfactory, if the patient cannot count or name the fingers held before him, his head of course being turned away from the light, the rubbing must be renewed. No inspection of the pupil by the surgeon gives information comparable to the actual exercise of vision by the patient himself; nor should the bandage be applied until the sight seems reasonably good. If, indeed, there were no other reason for this course, the advantage of the moral effect produced on the patient can scarcely be over-rated.

The corners of the wound must now be carefully examined to see whether iris tissue has become incarcerated



there. Should this be the case the flat rubber spatula may be used for its replacement, pushing it first out of the wound, and then gently patting or spreading it out in its proper position. The importance of thus clearing the wound, as well as the danger of allowing a prolapse of iris to heal into the cut, can scarcely be exaggerated. As soon as the anterior chamber has become re-established the influence of the escrine will again be asserted, and offer an additional safeguard against this accident. After the remains of the cataract and coagulated blood have been removed from about the wound and from the conjunctival sac, by means of the edge of a bit of soft linen or a similar fragment of sponge, the conjunctival flap is to be carefully lifted into place by the iris forceps and the eye closed; care being taken that the upper lid, in its descent, does not reverse the flap.

*Accidents during the Operation.*—The most dreaded is the escape of vitreous. This may be due to a faulty position of the wound, to intra-ocular disease resulting in abnormal fluidity of this humor, or to the employment of undue pressure in expelling the cataract. While the moderate loss of vitreous may be simply followed by a lengthened and irritable convalescence, its escape in any considerable quantity is apt to entail retinal separation, choroidal disease, or even general inflammation of the eyeball. The accident is characterized by the appearance in the wound of a transparent viscid fluid. If it occurs immediately after the completion of the cut, the iris is to be quickly excised. The removal of the lens has now to be effected, with as little further escape of the humor as possible. Any pressure would, of course, increase this tendency. No attempt is to be made to open the capsule, and the lens is to be removed by traction



FIG. 1163.—Critchett's Scoop.

with an appropriate instrument. For this purpose the writer has always employed Critchett's scoop (Fig. 1163), an instrument that combines lightness with flexibility, and effects reliable traction; occupying the while comparatively little space in the eye and distending the edge of the pupil but slightly. Its employment demands a quick eye and a steady hand. If the eye is deep-set the instrument is to be somewhat bent, and is then to be introduced with the patient looking down, and in such a direction that its edge slips behind the periphery of the lens. It is now quickly passed down until its lower rim is thought to be opposite the base of the lens, the handle is then to be sharply but gently inclined backward, and the instrument at the same time drawn up and out of the eye, bringing the lens with it. This manoeuvre bears a distant resemblance to that by which a lever pries a stone out of the ground. A gush of vitreous generally occurs at the instant the lens emerges; the eye is, therefore, to be instantly closed and dressings are to be applied. The lens is thus extracted in its capsule, and subsequent vision is apt to be unusually clear and distinct in cases in which a good recovery is made.

Where, after the operation, vitreous simply projects at the edge of the wound, separating its lips, some advise excision of the prolapsed portion with fine sharp scissors. It is better practice to leave it alone and trust to the influence of the pressure bandage to effect its subsidence. Should this prolapse occur after the nucleus has passed out, but before the pupil has been thoroughly freed from cortical substance, the operator finds himself between the two horns of a dilemma. The lesser evil is to close the eye at once and trust to time for the absorption of the remaining cortical. Bleeding into the anterior chamber may occur during either of the several stages of the operation, and has already been alluded to.

*Bandages and After-Treatment.*—An elliptical patch of soft linen is to be laid on the eye, and the orbital hollow filled with small tufts of corrosive cotton, as was described in connection with the after-treatment of linear

extraction. In the present case, however, one eye is already closed by strips of plaster, and the bandage is, therefore, to be monocular. Every surgeon has his favorite form; the writer prefers a flannel roller, 4.5 mm. in width, and long enough to encircle the head three times alternately with a similar number of rising turns over the eye, one fold overlapping the other, the whole affording moderate compression and support. If the weather be very warm, gauze may be advantageously substituted for flannel. The bandage once applied, the room is to be darkened and the patient left in quiet for a few hours. He is to avoid turning over on the side of the operated eye. Should he desire to vary his position by lying on the opposite side, he is to lift his head slightly from the pillow, so as to avoid dragging on the bandage. Should the operation have been performed in the morning, the patient may be seen again in the course of the afternoon. At this, as well as subsequent visits, it is well to avoid letting in daylight, on account of the great change in illumination that may unexpectedly occur. The sudden emergence of the sun from behind a cloud may unexpectedly flood the room with light and distress an eye used to entire darkness. A single candle is the best and most easily managed source of illumination. By the time of this visit the pad next the eye will generally be found more or less stiff and uncomfortable, having become soaked with blood and tears. It should, therefore, be changed. The outside of the lids may be gently bathed with a soft compress dipped in lukewarm water, but they are on no account to be separated unless something unusual has occurred. To this end the patient is to be cautioned, before the bandage is removed, not to open his eye, but to keep it softly closed. The feeling of soreness and the sensation of a foreign body between the lids will by this time have probably died away. The dressing having been renewed a bed-chair may be brought in, and the patient allowed to rest himself by sitting up in bed for a short time. Later in the evening a dose of chloral may be given. It is well to have a watcher in the room the first one or two nights.

At the visit on the following day, if the case be progressing favorably, the lids are again to be washed and the bandage is to be renewed, but the eye is not to be opened. From this time forth the bandage may be changed once in twenty-four hours. By the third day the plaster used to close the other eye will ordinarily be found to have become quite stiff, and its edges will have rolled in, causing some discomfort. It is therefore to be soaked off. A Liebreich bandage may now be used over both eyes, instead of the flannel roller. By this time, too, the patient may sit up in an easy chair and have his bed made. He is to spend an increasing portion of every day out of bed until he occupies the latter only at night. The diet is to be nutritious, but all chewing should be strictly avoided. The room should still be kept darkened.

There is, among ophthalmic surgeons, a great diversity of opinion as to when the lids should first be separated and the eye examined. Arlt lays down no fixed rule, but intimates that this may occur at the second visit, twenty-four hours after the operation; and even sooner if necessary. The experience of the present writer has led him to adopt a different course. He gradually came to find that the eye did quite as well if the lids were allowed to remain closed two or even three days. As time went on, a new fact forced itself repeatedly on his notice; that in certain cases, in which the healing process was interrupted by inflammatory complications, the first pain, lachrymation, or discharge followed accurately on the first separation of the lids, however carefully managed and however hasty the examination. The case might have been doing perfectly well for three or four days; no swelling of the lids, lachrymation, or undue discharge being present, or the slightest pain experienced; the eye might then, for the first time, be opened and rapidly surveyed by a weak light, no lens being used and no trial of the vision made, and yet within a few hours pain would occur and marked symptoms of inflammation be present. This happened so frequently that it became impossible

not to connect the examination and the inflammation as cause and effect. Acting on this belief he kept prolonging the time that he allowed the eye to remain unopened, and now he rarely makes the first examination before the morning of the eighth day. At this time it is often remarkable to see how little evidence of the operation is present, a trifling redness in the immediate vicinity of the wound being sometimes all there is to be seen. This redness, slight at first, will be observed for several days steadily to increase before it begins to disappear.

The above course of treatment is applicable only to cases in which the healing process may be presumed to be progressing normally. The writer believes that the longer the examination is deferred the more likely the patient is to do well, and he bases this opinion simply on experience. Of course, numerous theoretical objections to such a method might be alleged. It could be argued that the secretions of the wound, and the blood left in the conjunctival sac, being unable to escape, might decompose and act as sources of infection. This and other objections might be brought forward. To those urging them the writer simply suggests a fair trial of the plan itself, believing that they will in the end themselves find that the longer they leave the wound undisturbed, in contact with and guarded by the covering provided by nature, thus sealed and protected from any germs of contagion with which the atmosphere may be infected, and which the exposure of a single instant might attract, the more success they will meet with in the after-treatment of extraction.

One caution must here be given. While, as a rule, both eyes should remain covered until the eighth day, it must be borne in mind that some aged and weak people are peculiarly sensitive to the combined effects of darkness and solitude, and may be attacked by a form of delirium which renders them difficult to control. If this occurs the sound eye may be sooner uncovered, perhaps on the fourth or fifth day. After the removal of the bandage from both eyes, light may gradually be admitted into the room, the patient wearing a shade, or a pair of blue or smoked protective glasses curved to cover the eye more effectually, the so-called "coquille" spectacles. Several days should still be suffered to elapse before the patient is discharged from the immediate supervision of the surgeon. During this time the pupil is to be carefully watched, and atropine used if it evinces a tendency to contract, or if its area is at all occupied by remains of blood or cortical substance. Fifteen days after the performance of the operation the patient may ordinarily go to his own home, but he is to wear the protective glasses for a month or six weeks longer, and to avoid exposure to bright light, or any use of the eyes. When six weeks have elapsed after the removal of the cataract he may cautiously commence the use of the appropriate glasses.

We have thus far considered a case of uncomplicated recovery, and must be prepared to deal with departures from this type, they being unfortunately not infrequent. Unusual duration of the pain connected with the operation itself may often be relieved by removing the bandage and washing the outside of the eye with ice-water. If it still continues, the edges of the lids may be examined to see if any lashes have become inverted, and the under lid may be slightly drawn downward to allow the escape of any accumulation of tears. Cold compresses may be alternated with the compressive bandage, or even a morphine injection may be made in the temple. In extreme cases the linen pad next the eye may be thoroughly wet with atropine, although the use of a mydriatic should, if possible, be dispensed with for several days after the operation, on account of the danger of prolapse into the corners of the wound. If the pain continues, or even if, in the absence of pain, the lids swell and lachrymation or discharge be present, the eye must be opened and carefully examined by oblique light, the candle being held to one side and its rays concentrated on the eye by means of a convex lens of short focus. Iritis, if present, is to be treated by leeches to the temple, atropine, and

the alternation of the bandage with warm, but not hot, fomentations. If there are signs of suppuration in the wound, the fomentations are to be even more regularly applied, twenty minutes at a time, every four hours, and the bandage is to be kept on in the interval, being applied even more tightly. The eye may, moreover, be bathed with the following antiseptic solution: Salicylate of sodium, 1 gm.; boracic acid, 3 gm.; dissolve in warm water, 100 gm.; stir well, cool slowly, and strain.

Compresses wet with this solution may be constantly kept on the eye; if the inflammatory process continues and no benefit is derived from the fomentations and the bandage, quinine should be given in large doses, and the general health supported with generous diet and stimulants. The previous history and habits of every patient are to be well weighed by the surgeon; those addicted to the free use of stimulants would incur great danger of an unfavorable result if these were suddenly suppressed. Should any form of opium have been habitually indulged in, the customary ration must be allowed.

If thirty-six or forty-eight hours pass without accident it is probable that the eye will be saved, and some measure of sight retained. Iritis is still possible, but, if properly treated, is unlikely to result in blindness. One great danger to be guarded against during convalescence is a sudden blow on the eye, inflicted by the patient himself during sleep or carelessly when awake. This may cause bleeding into the anterior chamber, or even rupture of the wound. The blood may be absorbed or the wound heal under a prolonged application of the bandage, and no ultimate ill effect be experienced; or a state of chronic irritation may follow, ending in closure of the pupil and necessitating the performance of a secondary operation. Or, at the worst, irido-cyclitis may ensue, the pupil closing and the iris being drawn forward until the anterior chamber is obliterated, all perception of light disappearing after weeks of suffering. There are even instances on record of this condition of things causing sympathetic irritation and ultimate loss of the remaining eye. It would be well, therefore, to proceed to enucleation in the case of an eye in this condition, especially if tenderness on pressure exists.

*SECONDARY OPERATIONS.*—After an ordinary extraction the anterior capsule retracts and leaves the area of the pupil occupied, substantially, by the posterior capsule only, thus exposing any portions of cortical substance that may remain behind to the full action of the aqueous humor. In cases, therefore, in which the cataract was not entirely mature, and in which lens substance as yet clear has escaped notice and been left behind after the operation, it may happen that a pupil which at first appeared clear and black is discovered, on removing the bandage, to be entirely blocked with opaque cortical masses, swollen and pressing forward. These may be absorbed quietly and vision be slowly gained. But they are more apt to give rise to inflammation of the iris, by the mechanical pressure which they exert upon it, and to cause this membrane to contract adhesions with them. After the inflammation subsides we may thus find a pupil contracted, drawn up, and filled with a dense membrane, a so-called secondary cataract. Another form of secondary cataract is the opacity of the capsule or the deposit of opacities on the capsule that sometimes occurs long after the extraction, and that does not appear to be connected with any unusual feature, either of the operation itself or of subsequent convalescence. Patients often return, years after the cataract has been removed, complaining that their vision, originally excellent, has gradually undergone diminution. The power of reading any but the largest type may perhaps have entirely disappeared. The capsular opacities in these cases are often apparently insignificant, hardly visible indeed by oblique illumination. But the ophthalmoscope shows the outline of the optic nerve to be indistinct and distorted; and the mirror alone, particularly that of the binocular instrument, plainly reveals a delicate web of opaque capsule stretched across the pupil, now distinct in one part and now in another, as the handle of the instrument is slightly



rotated, and the direction of the reflected light thus changed.

To bring about a return of vision it is necessary to secure a permanent opening in this capsular screen. Numerous devices have been imagined for the accomplishment of this. Dissection with a single needle is rarely sufficient. The introduction of a hook, through a small opening made for this purpose at the edge of the cornea, enables us to tear away a piece of the capsule, but may, give rise to a dangerous amount of traction, and thus result in irritation or inflammation of the ciliary body. To avoid this, Bowman devised the so-called "double-needle operation." Two ordinary dissection needles are used; one is taken in the left hand, is passed through the middle of the inner half of the cornea, and made to penetrate the thickened capsule; the other is held in the right hand, passed through a corresponding point in the middle of the outer half of the cornea, and introduced into the capsule by the side of the first. One needle is then held still while the other tears from it, or else each is made to tear the capsule in an opposite direction. In either case a *point d'appui* is gained, and the strain no longer comes on the ciliary body. Among other ingenious operations of this class is one devised by Dr. C. R. Agnew, of New York. Passing his first needle through cornea and capsule, as in Bowman's operation, he makes an incision with a broad needle at the opposite corneal edge, being careful in withdrawing this needle to allow no escape of aqueous by its side. He then passes through the opening a sharp and flexible hook, engages its point in the capsule just where it is pierced by the stop-needle, and tears a hole from this needle which thus acts as a point of support.

Where the pupil is drawn up and filled with tough membrane, or remnants of lens substance enclosed in opaque capsule; where the iris, tightly stretched and thickened by inflammation, obstructs all access of light to the retina, the operations above described are impracticable. Simple iridectomy is rarely resorted to, owing to the difficulty experienced in grasping and withdrawing sufficient iris tissue. Iridotomy, incision of the iris itself, is here to be advised. Wecker's scissors, sometimes used for this purpose, are a pair of short and delicate blades, made to open and shut by the lateral movement of the two sides of the long forceps handle to which they are attached. A lance knife is first passed through cornea and iris, and the scissors are then introduced into the opening in the latter and used to give it increased length, one arm being inserted behind iris and thickened capsule, the other in front of them. If the wound thus made gapes, disclosing a clear black pupil, no further interference is necessary; if not, a second incision is made at an angle to the former one. The included flap may even be withdrawn with iris forceps and excised. Far simpler, and, in the writer's opinion, safer, is the incision of the iris and capsule by means of a narrow Graefe knife passed obliquely through cornea and iris, and made to act as a lever, incising the latter by simply raising or depressing its handle, according as its edge looks up or down, the cornea in this case acting as the fulcrum. By introducing the knife in a new place a second incision may be made at an angle to the former one. Vitreous is much less likely to be lost when iridotomy is done in this manner.

*Simple Extraction or Extraction without Iridectomy.*—This operation is daily finding its way into more general use. It cannot be said to have supplanted the one just described, as each has its appropriate field. But extraction without iridectomy has become the more popular method, while the old operation is beginning to be confined to a daily diminishing class of selected cases. It might be well to preface the description of the operation by a brief account of its advantages and disadvantages.

The advantages of the non-performance of an iridectomy are simply and concisely stated by Professor Pflüger (*Kl. Monatsblätter für Augenheilkunde*, May, 1892, p. 161). He considers the return to simple extraction to be the greatest improvement in the cataract operation that

has occurred for twenty-five years, and for the following reasons:

The conservation of the normal pupil combines optical with antiseptic advantages, in regard to the first part it having been proved that the corneal refractive power is at its best in the centre of that membrane; moreover,

(1) There is no wound of the iris, and hence far less likelihood of a depot for the collection of offensive, that is, infectious material;

(2) There is no bleeding into the anterior chamber, to obscure the subsequent steps of the operation;

(3) The wound is protected by the intact iris from contact with fragments of capsule, the presence of which so often causes slow healing and secondary infection, leading it may be to chronic irido-cyclitis and even to sympathetic affection of the other eye;

(4) There is a certain amount of protection against loss of vitreous;

(5) Pflüger's experience leads him to think, strange as the fact may appear, that there is less danger of secondary glaucoma in the case of a simple extraction.

It is not asserted that the percentage of corneal supuration is affected by the performance or non-performance of an iridectomy. Stress is laid on the claim that, after successful simple extraction, the excentric vision is better and light better borne. On the other hand, it may be replied that the iridectomy need not be a large one, and that being made directly upward it is largely covered by the upper lid, thus insuring a considerable use of the centre of the cornea.

Furthermore: 1. Considering the extent of the corneal wound, as well as the frequently large solution of continuity of the conjunctiva itself, the additional terrain afforded by the iridectomy for the collection of infectious material would be a matter of small account.

2. Bleeding is reduced to a minimum by the action of the cocaine, and frequently is entirely absent.

3. If prolapse of the iris, or even dislocation of the pupil occurs, the capsular fragments may yet come in contact with the wound, and these capsular fragments, as well as cortical remains, can be both more perfectly detected and thoroughly removed where the area is laid bare by an iridectomy.

4. That the statistics of simple extraction show a lessened percentage of vitreous prolapse, as compared with the Graefe operation, is not as yet universally admitted.

5. The same may be said in regard to the occurrence of glaucoma. The experience of individual operators is here at variance. Dr. Knapp, in 1890, reported three cases of glaucoma as occurring among one hundred simple extractions (*Archives of Ophthalmology*, vol. xix., p. 299).

There are two serious drawbacks to simple extraction: The first is the difficulty in clearing the pupil of cortical and capsular remains, after the lens has been delivered. It is obvious that, with an iridectomy, there is a larger pupillary area in view and a wider aperture for the extrusion of whatever may occupy it. Moreover, the manoeuvres we generally employ for the clearing of the pupil, the tilting and rubbing, tend to maintain, if not to produce, the presence of the iris between the lips of the wound, and to render its ultimate reposition more difficult.

This leads directly up to the main objection to simple extraction, the liability to iris prolapse. This accident is met with in from seven to ten per cent. of all cases of this operation. Its disadvantages are the change thereby wrought in the corneal curve, the dislocation of the pupil, the lengthened convalescence entailed, and the tendency to cystoid cicatrization of the wound. It is most likely to occur in consequence of a sudden motion or injudicious effort on the part of the patient within the first few days after the operation, and may be brought about by the forcible contact of the hand with the eye during sleep. The wound being ruptured, the aqueous humor escapes, and carries with it the iris, which remains incarcerated between the lips of the wound. A sudden sharp pain is sometimes felt and arouses suspicion as to what may have occurred. But there are cases in which

no imprudent motion is known to have taken place, and no warning has been sounded, and yet in which the first inspection of the eye, several days after the operation, reveals an extensive iris displacement.

The tendency of the eye to undergo this accident is well illustrated by the statistics of a third series of 100 cataract extractions without iridectomy, published by Dr. Knapp (*Archives of Ophthalmology*, vol. xix., p. 280).

In 7 of these cases iridectomy had to be performed during the operation.

In 2 cases the iris folded itself over the knife and was excised.

In 8 cases prolapse and incarceration of the iris occurred during the healing process.

Eighty-three of these patients therefore recovered with fair, round pupils, 15 either had iridectomy performed or would have been better off had this been done. In a recent letter Dr. Knapp informs me that his confidence in simple extraction is undiminished, and that he employs it in fully 90 per cent. of all his cases.

*PERFORMANCE OF SIMPLE EXTRACTION.*—The long, narrow knife of von Graefe may be used for the corneal incision, the puncture and counter-puncture being made just above the horizontal meridian of the cornea, in the transparent periphery of this membrane, the apex of the cut alone encroaching on the limbus. This is the course taken by experienced operators like Knapp, who aim at the avoidance of the periphery of former years. The capsule opening is made by some at the same time, and with the same knife used in the incision; by others with a special cystitome, and may be central or peripheral, either method having its advocates. Sometimes a piece of the anterior capsule is removed with forceps specially constructed for this purpose. To expel the lens pressure is made at the base of the cornea, through the lower lid, while the upper lip of the wound is at the same time slightly depressed by means of pressure made through the upper lid. After the delivery of the lens, the pupil, if still occupied by fragments of cortical or remains of capsule, may be freed by judicious manipulation, or irrigated with a sterilized solution of boric acid or common salt, either one-half or one per cent. in strength. These solutions should be slightly warmed and but little force used in their introduction. For this reason the syringe originally employed by McKeown will be found less manageable, as well as more difficult to sterilize, than the apparatus of Lippincott (Transactions American Ophthalmological Society, Twenty-seventh Meeting, p. 115), or the "undine" of Wicherkiewicz. The writer has modified the latter instrument by attaching to its large aperture a short rubber tube, ending in a glass mouthpiece. Both hands of the operator are thus left free; he holds the mouthpiece between his teeth, and is enabled at will to modify the pressure to any extent, or even to reverse it and withdraw masses of cortical by suction into the apparatus itself. Solutions of corrosive sublimate are no longer used for irrigation, on account of the corneal opacities they were found occasionally to induce. Care must be taken to keep the opening of the irrigator as far from the pupillary edge as possible, prolapse of the iris being readily encouraged by its too immediate contact with this region. It is at best a clumsy instrument and its use a choice of evils.

After the clearing of the pupil and anterior chamber has been completed the iris must be carefully replaced, there being no better instrument for this purpose than a flat, narrow rubber spatula. If reduction be found impossible, or the iris shows a tendency to fall back into the wound, a small iridectomy must be made on the spot. In any case a solution of eserine (one per cent.) or pilocarpine (two per cent.) should be dropped into the eye before closing it.

It has of late been seriously proposed by certain surgeons that the non-operated eye be left unguarded, that only a light dressing be applied to the other, and that the patient be kept in an undarkened room and allowed much freedom of motion. Good results are claimed from such an absence of treatment. This, if true, would reverse

our traditions and revolutionize our practice. But as yet the only evidence in its favor is that of vague assertion, unsupported by definite statistics. Its advocates are at present few.

Iris prolapse being, as has been stated, often due to the sudden escape of the aqueous humor, consequent on a rupture of the corneal wound, an ingenious means of obviating this has been devised by Dr. H. B. Chandler, of Boston, and proposed by him as a modification of the operation. He makes a small opening in the iris in order to allow the free escape of the aqueous, which collects behind this membrane, and claims that this prevents prolapse.

His description of the operation is as follows: "After making a corneal cut, exactly at the cornea-scleral junction, a very small piece of iris, about 1 or 2 mm. from the periphery, is caught up, either by means of a fine iris forceps, with teeth situated on the lower portion of the blade, as near the point as possible, or by means of a sharp hook, the bent portion being at right angles and about 1 mm. long, and gently drawn out, is cut horizontally as close to the gripping instrument as possible; this leaves a small round opening, not more than 1 to 2 mm. in diameter" (*Boston Medical and Surgical Journal*, October 16th, 1890, p. 366).

For two or three days after a simple extraction greater quiet is necessary than is the case when iridectomy has been performed, the patient being cautioned to avoid straining and all sudden exertion. The occurrence of severe pain in the eye, or even a feeling of irritation, such as might proceed from the presence of a foreign body, should arouse suspicion of prolapse. If this comes on within two days after the operation the eye must be opened and the protruding iris reduced or excised. Otherwise it is better to leave it alone until the wound is thoroughly consolidated. After a lapse of several weeks the prolapse, if it shows no signs of flattening, may be excised or cauterized.

And now comes the practical question as to which of these two methods of extraction, the combined or the simple, is to be employed in a given case. In the present state of our knowledge the first thought of the surgeon is undoubtedly a desire to remove the cataract without the mutilation of the eye which accompanies an iridectomy, provided this can be done with safety. It is therefore well to sum up the contraindications to the simple operation. Concerning these, opinions vary, yet it may fairly be conceded that extraction with iridectomy is a safer method when:

- The patient is well advanced in years.
- When he is very nervous or restless, impatient of restraint or devoid of self-control, prolapse of the iris being under such circumstances more to be dreaded.
- When the diameter of the cornea is less than usual, or when the pupil fails to dilate properly under the influence of a mydriatic.
- When the presence of a tremulous lens, or antecedent disease, gives reason for apprehending fluidity of the vitreous.

(e) When posterior synechiæ exist.

(f) When prolapse of the iris, occurring during the operation itself, does not admit of reposition.

The exclusive employment of one method of extracting cataract would seem unwise. Each case must be taken on its own merits; its history, the condition of the eye, and the disposition of the patient carefully considered, and the operation selected that seems likely to be followed by the best results. Doubtless a successful simple extraction leaves the eye in a more normal condition, and thus affords a more perfect result. To gain this result the operator requires a maximum of experience and skill, while the patient must be prepared for a somewhat more burdensome convalescence, and must also be willing to incur a slightly increased risk of accident.

It is impossible, in an article like the present, to review all the different operations for the extraction of senile cataract that have been proposed, even within the present generation. Those just described are the ones in general