It should be pointed out, however, that there was a certain amount of overlapping. For instance, mental deficiency was often associated with albinism.

Conclusions

(1.) That absence of the light fixation reflex in infants, with otherwise normal eyes, is often an early sign of future mental deficiency.

(2.) That delay in the appearance of the light fixation reflex is often associated with a pigment deficiency affecting the retina and choroid. That in these cases the light fixation is delayed only and will appear in due course.

(3.) That the pupil reaction to light was only absent in those cases in which there was a definite disease of the optic nerve. All the cases of temporary amaurosis and of mental deficiency in this series presented an intact pupillary reflex arc.

(4.) That congenital syphilis was established in only seven cases of this series.

(5.) That such features as consanguinity of the parents, difficult labour, and premature birth of the infant, did not figure to any great extent in these cases.

(6.) That the presence of eye rubbing usually denoted a local defect in the eyeball, such as cataract, refractive error or pigment deficiency.

SUB-CONJUNCTIVAL CATARACT EXTRACTION

BY

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DUNDEE

A PRELIMINARY communication on *sub-conjunctival cataract extraction* was made to the Forfarshire Medical Association in March, 1914, and published in the *Edinburgh Medical Journal* of May, 1914. In that communication we drew attention to what must always be regarded as a non-surgical procedure in the technique of senile cataract extraction, namely, leaving a comparatively large wound in the sclero-corneal region open and unprotected. Suturing the lips of the wound has from time to time been recommended, but, obviously, it is a somewhat complicated and difficult procedure, and, considering the delicate

structures involved, is, in the opinion of most operators, undesirable. It is true that in a well-performed cataract extraction the lips of the wound usually lie in good apposition at completion of the operation; but, owing to restlessness on the part of some patients, the lips of the wound are liable to become displaced, and so the healing process may be retarded or the safety of the eyeball imperilled. A fit of coughing, sudden movement, or such like eventuality may supervene, and mar the most skilfully performed operation. To minimize such occurrences sub-conjunctival extraction has been practised in special cases by a few operators at different times, but so far this method has not become a regular surgical procedure in the extraction of senile cataract.

A form of sub-conjunctival extraction was advocated by Alexander as far back as 1825, by Desmarres in 1851, by von Hasner in 1873, and by Pansier and Vacher in 1899. In 1903 Czermak recommended sub-conjunctival extraction for cases in which there is danger of loss of vitreous, either during the operation, owing to dementia, excitement, dislocation of the lens into the anterior chamber, over ripeness, and the like; or, after operation, from gaping of the wound through great restlessness, violent paroxysms of coughing, etc.

"The procedure for sub-conjunctival extraction," as recorded in Haab's Atlas⁽¹⁾, "consists in making a broad conjunctival flap with the base above, which is not divided posteriorly, so that the edge of the corneal wound is connected with the equatorial conjunctiva by a broad bridge of conjunctival tissue. This makes it impossible for the wound to gape; at the same time, however, it is more difficult to express the cataract under the conjunctival bridge. The latter should be made before the anterior chamber is incised, but, owing to the greater difficulty of extracting the cataract through an upper incision, iridectomy is absolutely indispensable."

Czermak's sub-conjunctival extraction⁽²⁾, which is different from that described by Haab, consists in making a conjunctival pouch below the cornea, open on the temporal side only. Into this pouch the lens is expressed during the process of extraction. He uses a large Graefe knife, with which he enters the anterior chamber at the temporal end of the horizontal meridian of the cornea, the puncture being made through the conjunctiva well behind the limbus. The point of the knife is then directed towards the centre of the pupil, and, acting as a cystotome, divides the anterior lens capsule. The knife is withdrawn, and another incision is made through the conjunctiva downwards for about fifteen millimetres. The lower part of the conjunctiva is undermined from the lower end of the vertical conjunctival incision inwards and upwards along the limbus to a little beyond the inner

end of the horizontal meridian of the cornea, care being taken not to cut through the conjunctival pouch thus formed. By means of a pair of blunt-pointed scissors, the posterior blade being introduced into the anterior chamber, and the anterior blade underneath the conjunctival bridge, the cornea is divided around the margin to the inner end of the horizontal meridian. By pressure over the ciliary region above, and by simultaneous pressure backwards on the posterior lip of the wound, the lens is expressed into the conjunctival pouch below, whence it is easily removed by a curette. The wound in the conjunctiva is closed by a couple of sutures inserted horizontally. Eserin is instilled, a protective bandage applied, and the patient kept as quiet as possible for some time after the operation.

Czermak's operation was modified and somewhat simplified in 1907 by Dimmer⁽³⁾, who incises the conjunctiva for a distance of eight millimetres at a point downwards and outwards eight millimetres from and parallel to the limbus. The bulbar conjunctiva is then freely undermined half-way round the cornea up to the limbus. The subsequent corneal incision is divided into three stages. The middle third is done by means of a keratome, and this incision is extended on each side by scissors till one-half of the corneal circumference is divided. The capsule of the lens is then opened by a cystotome, and the lens expelled as in Czermak's operation. Thereafter the conjunctival wound is closed by a single suture.

Cluckie of Greenock⁽⁴⁾, in 1909, described a method of sub-conjunctival extraction similar to that described by Haab. The operation proceeds as in an ordinary cataract extraction to the point where there is left a connecting bridge between the cornea and conjunctiva about four millimetres broad. Instead of completing the section in the usual manner, leaving a small conjunctival flap adhering to the anterior lip of the corneal wound, the Graefe knife is carried upwards and backwards under the bulbar conjunctiva for some twelve millimetres, and is then withdrawn without cutting through the conjunctiva. By this procedure a corneo-conjunctival bridge covers the deep wound, which enhances the chances of success and ensures a speedy recovery. Iridectomy, if desired, may be done, preferably upwards and inwards. The capsule may be ruptured before or after the iridectomy from the temporal side and the lens thereafter extracted.

Bajardi⁽⁵⁾, in 1910, described a method of sub-conjunctival extraction essentially similar to that described by Cluckie. The conjunctival flap is cut from twelve to fifteen millimetres broad by means of the Graefe knife; iridectomy and capsulotomy are then performed, and the lens is extracted by a Daviel spoon applied to the posterior lip of the wound beneath the conjunctival bridge, and

by simultaneous pressure from below by means of another spoon placed over the ciliary region.

During 1912 to the middle of 1914 we performed sub-conjunctival extractions in special cases as occasion arose somewhat after the manner first described by Haab, and subsequently by Cluckie and Bajardi, with most satisfactory results. To begin with, the cases on which we performed sub-conjunctival extraction were those in which prolapse of the vitreous from a weakened suspensory ligament was anticipated, those not likely to submit to the necessary post-operative discipline, those suffering from chronic cough, and especially those in whom the environment of the wound from an aseptic standpoint left much to be desired.

At the outset we did not regard the technique of the operation as easy, especially in the case of patients with small palpebral apertures, and in those that could not be depended upon to keep steady during the operation and rotate the eyeball downwards in the required direction. This is probably the reason why sub-conjunctival extraction has never become popular with operators. After a little practice, however, the technique becomes quite simple; and, when the operation is successfully performed, its advantages are so obvious as to be instantly appreciated.

In our early cases of sub-conjunctival extraction we invariably performed iridectomy after completing the sclero-corneal section and conjunctival bridge; but, finding removal of the piece of iris at, or near, 12 o'clock difficult owing to the broad conjunctival flap, we soon discarded iridectomy altogether in favour of simple extraction, i.e., without iridectomy. This procedure we found to be thoroughly justified as the risk of iris prolapse with the wound protected by the conjunctival flap was practically negligible, provided certain precautions were rigidly adhered to.

Being engaged on military service throughout the greater part of the War, our opportunities for cataract extractions in private and hospital practice were very considerably curtailed; but, after demobilization in February, 1919, when regular practice was resumed, we have done all our cataract extractions—some three hundred to date—by the sub-conjunctival method without iridectomy, except in a very few cases, where, for one reason or another, preliminary iridectomy was performed some six weeks before extraction.

When the lens is ripe, or sufficiently ripe, for extraction, and, being satisfied that there is no dacryocystitis, inflammatory condition of the conjunctiva or lid margins, and that the general health is satisfactory, we give the patient astringent drops consisting of zinc sulphate, alum and boric acid (2, 1 and 4 grains respectively to the ounce), or fresh undiluted collosol argentum, three drops to be instilled into both eyes three times a day for three

weeks before the patient is admitted to hospital. On admission the same drops are continued till the morning of the operation, when the eyelashes are cut short, and the face thoroughly washed. We prefer the patient to be in hospital for forty-eight hours before operation so as to become accustomed to his new environment. A careful examination is made by the house surgeon of all the systems, and the result duly reported to the operator. Should this report be satisfactory, a mild aperient is given the evening before operation, followed by an enema in the morning, to ensure that the bowels are emptied in the early morning. For some years past we have operated on the patient in bed in the ward with great advantages in every way, the object being to disturb the patient as little as possible both mentally and physically before, during and after operation. When the head of the bed is inconveniently high for the operator, the patient's head is placed at the other end, and the bed put in the best position possible for light a short time before preparations for the operation are begun. Whenever the patient shows any signs of nervousness, the house-surgeon is instructed to give a hypodermic injection of $\frac{1}{4}$ 0.25 cc. of trivalin-hyoscin (*The Saccharin Corporation, Ltd.*)—half-an-hour before operation, as recommended by Elliot⁽⁶⁾ in glaucoma operations. This has been found most satisfactory by patient and operator alike. Some twenty minutes before operation a few drops of a freshly prepared 5 per cent. sterilized cocain solution are instilled into both eyes, followed immediately by a few drops of 1 per cent. pilocarpin solution to the cataract eye only to prevent cocain mydriasis, and repeated every three minutes, the eyelids being kept closed in the interval to guard against corneal desiccation.

When the morning of operation is dull, artificial light is substituted for daylight by means of an adjustable electric standard lamp with parabolic reflector. The pillow on which the head rests is completely covered over with sterilized jaconet and not removed after operation for a few days, and the patient's hair concealed by an india-rubber bathing cap.⁽⁷⁾ Under the head rests transversely some thirty inches of narrow tape with which is secured the large double shade applied after operation. Over the upper part of the bedclothes, and tucked well under the shoulders, is laid a large sterilized jaconet, to ensure as thorough an aseptic environment of the field of operation as possible. This is how the surgeon finds his patient on entering the extemporized operating theatre.

Gloves are not worn, the surgeon trusting to produce sterilization of his hands by scrubbing with nail-brush and soap under a running tap of warm water to remove all grease and then the immersion of his hands for a couple of minutes in a solution consisting of 1 in 1,000 perchloride of mercury and 1 in 80 carbolic.

A further precaution is meticulously adhered to—never to touch the wound, or the part of the instrument that comes in contact with the wound, not even with disinfected fingers, for in all operations the fewer hands and instruments the better.

Preparation of Instruments.—If the surgeon wishes a keen edged knife and strict asepsis, he should have his own instruments and keep them under lock and key. He should also personally see to their disinfection and storage, and keep all edged instruments well smeared with sterilized vaseline when not in use. The knife with which we did our latest cataract extraction in the Dundee Royal Infirmary has done 45 extractions without sharpening, and is still serviceable, very probably because of the reason above mentioned, and the fact that the knife and cystotome are not boiled along with the other instruments in the sterilizer, but are disinfected, after the vaseline has been removed by a soft linen handkerchief, by immersion in pure ether and transference to absolute alcohol. When the other instruments, arranged in order on the sterilizer tray, have been in ordinary boiling water (preferably distilled) for three minutes at least, the knife and cystotome are placed on the tray alongside the others by the surgeon, and dipped in the sterilizer to remove all traces of the above disinfectants. The tray containing the instruments is then removed by the sister, and placed on a convenient stand to the right of the patient's head, no fingers being allowed to touch the instruments till required by the surgeon.

Final Preparations of the Eye.—After a kindly greeting to the patient, and a reassurance of no pain from beginning to end of the operation, the surgeon proceeds to make final preparations. The patient is asked to close his eyelids as if he were asleep, and, after the edges of the eyelids are made to pout by gentle pressure, the surgeon cleanses the lid margins, and openings of the Meibomian glands and puncta by means of a cotton wool mop and warm sterilized saturated boracic solution. A Clark's speculum is then applied, and the upper and lower *culs de sac* are thoroughly flushed with tepid sterilized boracic solution by means of a sterilized all-rubber ball syringe of, say, two ounces capacity, the speculum being lifted well forward during the procedure to put the conjunctival folds in the *cul de sac* on the stretch. Finally, the whole of the conjunctival surface is freely irrigated with sterilized tepid isotonic salt solution from an undine⁽⁶⁾ to remove the boracic solution. At this juncture the patient may be told, what is literally the truth, that the only disagreeable part of the operation is over, and that the remaining part is quite simple, provided the eyes be kept looking steadily downwards, and no attempt be made to close the eyelids.

Description of the Operation.—The conjunctiva is firmly secured

by means of a fixation forceps applied just below six o'clock, when the patient is enjoined to look downwards as far as he conveniently can, and to keep looking steadily in that direction without fail till the operation is completed. The point of the cataract knife⁽⁹⁾ is inserted from the temporal side into the anterior chamber at a point 1 mm. behind the limbus, and about 1 mm. above the horizontal diameter. It is then passed horizontally through the anterior chamber and brought out at a corresponding point opposite. After the counter-puncture is completed, the scleral incision is carried upwards and completed in the ordinary way, but without dividing the conjunctival bridge. At this stage the edge of the knife is directed backwards, and by one or two sawing movements a conjunctival bridge is carried upwards from the limbus for a distance of not less than 12 mm., the bridge being made as broad as possible—the broader the better. The tendency to begin with is to make a narrow conjunctival bridge, but, with a little practice, one can generally get a bridge 10 mm. broad without difficulty. The anterior capsule of the lens is now freely divided with the cystotome in the pupillary area, or the central portion may be removed by capsule forceps. By depressing the posterior lip of the wound under the conjunctival bridge with a curette made specially broad and deep, and by applying steady pressure over the ciliary region from below upwards, the lens, as a rule, passes without difficulty through the pupil into the anterior chamber, thence upwards through the scleral wound under the conjunctival bridge, and then on to the conjunctival surface. During the process of expulsion care must be taken that the necessary pressure required with the spoon below be steady and continuous throughout, just as in the open method. After the expulsion of the lens the sub-conjunctival wound becomes instantaneously closed by the pressure over it of the conjunctival bridge, the deep wound becoming actually concealed. The toilet is completed sub-conjunctivally, and any cortical débris, left behind in the aqueous chamber and under the conjunctival bridge, removed by the same large curette and undine containing sterilized tepid isotonic salt solution without any difficulty and without any special instruments or apparatus. If necessary, the iris can be stroked back into position with the curette by simply passing a curette, held horizontally, through underneath the bridge, into the anterior chamber as far as both extremities of the wound. The iris can generally be replaced by one or two gentle strokes of the curette. After this the pupil should remain central and circular about 4 mm. in diameter. The operation being now completed, a few drops of sterilized pilocarpin solution 1 per cent. are dropped into the lower *cul de sac* from a drop bottle⁽¹⁰⁾, the speculum is removed and the eyelids are closed. Granted an ordinary-sized palpebral aperture, and a

steady patient, the whole procedure, from the moment of fixation of the eyeball till the lids are finally closed, can easily be accomplished in the space of thirty seconds, provided there be no hitch and no cortical débris. When cortical débris is left behind in the aqueous chamber after expulsion of the lens, it can generally be removed in a few seconds without any additional instruments or apparatus by using the large curette and undine containing sterilized tepid isotonic salt solution. A single plaster dressing (oval shaped, 2 by $1\frac{1}{2}$ inches), consisting of two layers of sterilized lint, taken out of sterilized boric solution, is applied, over which is placed a layer of dry sterilized absorbent cotton wool overlapping the lint below by $\frac{1}{4}$ inch all round. The dressing is kept in position by a vertical and horizontal strip of $\frac{1}{2}$ inch adhesive rubber plaster, the fellow eye being left with the eyelids closed but uncovered. A large double shade, made of two folds of brown paper, reaching from ear to ear and down over the nose, is applied and kept in position without moving the patient's head by the tape lying underneath the head. The bed, with patient, is now lifted carefully back into its former position in the ward, under the immediate direction of the surgeon. This can be done without any movement on the part of, or inconvenience whatsoever to, the patient. After a few optimistic remarks he is handed over to the resident staff, with instructions to keep him absolutely quiet, but as bright and happy as possible. The eye is examined in the evening by the sister-in-charge before going off duty, and, after instilling a few drops of pilocarpin, a fresh single plaster dressing is applied. Atropin is, as a rule, not instilled till forty-eight hours after operation. Then the pupil is kept just moderately dilated. The conjunctival wound heals very rapidly, and the deep wound follows suit without, as a rule, any interruption. The patient is allowed reasonable freedom on the fourth morning, and discharged three weeks after operation, with instructions to return in four weeks for spectacles or dilaceration, as the case may be.

1. *Difficulties arising during operation.*—If a fold of iris be caught in front of the knife, as occasionally happens in all cataract operations during section, an attempt is made to evade it; but, should this fail, we carry out the incision as if no obstruction presented itself, the worst that has happened in our experience being an accidental peripheral iridectomy, which in no way militates against the real success of the operation, except from a cosmetic point of view.

2. *A narrow palpebral aperture.*—In such cases the conjunctival bridge is carried upwards as far as the edge of the eyelid will permit, then the point of the knife is gradually withdrawn from the nasal side, and the incision carried at an angle upwards and

outwards underneath the eyelid sufficiently far to allow of the easy expulsion of the lens.

3. Should the lens not present in the anterior chamber under the usual pressure, it can be removed with little or no loss of vitreous by placing the ring of the vectis over the upper pupillary margin, drawing the iris sufficiently upwards with the vectis to allow the latter to be inserted at the upper edge of the lens and thence behind it. The iris, immediately after the use of the vectis, is generally prolapsed under the conjunctival bridge, but it is easily replaced by one or two strokes of the large curette as already described.

4. *Accidental division of the conjunctival bridge.*—This happened to us just after completing the scleral section in the case of a very old patient, who, although quite steady, had a very friable conjunctiva. An iridectomy was performed as if nothing had happened, and the operation was classified as an ordinary combined open cataract extraction.

Preliminary iridectomy.—In the few cases in which we have performed sub-conjunctival extraction some weeks after preliminary iridectomy, we found the operation to be simplicity itself, for the risk of entanglement of the iris during section, or prolapse after operation, was practically negligible. The great objection, however, to preliminary iridectomy as a routine procedure is that it necessitates at least two operations, which we consider to be altogether unnecessary, seeing that entanglement and prolapse of the iris are comparatively rare complications in simple sub-conjunctival extraction. Preliminary iridectomy may be advantageous to commence with till one gets familiar with the technique of sub-conjunctival extraction, but we feel confident that, after a few trials, the simple sub-conjunctival operation will be tried and found eminently satisfactory. It should be remembered that in simple extraction without iridectomy one very important advantage has to be placed to its credit, namely, the impossibility of lens capsule becoming incarcerated in the wound—a fertile source of future trouble.

In conclusion, the advantages we claim for simple sub-conjunctival extraction are:—The ease and rapidity with which the operation can be performed, the better protection of the wound from bacterial invasion, the safety against iris prolapse under proper care and pilocarpin, the securing of complete apposition of the lips of the deep wound during the healing process by the gentle pressure of the conjunctival bridge, and the beautiful cosmetic and physiological effect of a normal-sized, circular and movable pupil.

Judging by the results we have obtained during the past few years, we certainly would not revert to the old open combined

operation; and we, therefore, have no hesitation in recommending, with the utmost confidence, simple sub-conjunctival extraction as being the simplest and safest operation for the relief of senile cataract we know of at present. It is the operation we would desire for ourselves should such be necessary.

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HOLTH'S EXTRALIMBAL TANGENTIAL PUNCH FORCEPS SCLERECTOMY FOR CHRONIC GLAUCOMA*

BY

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HOLTH'S new operation for glaucoma, extralimbal tangential sclerectomy, has been performed in 52 cases at the University Eye Clinic at Christiania. In connection with Dr. Holth's paper, I here give the experience we have had with regard to this operation and its results.

In forty of the fifty-two cases the operation was performed for *glaucoma simplex*, in twelve cases only for other forms of glaucoma, viz., in six cases of buphthalmus, four cases of secondary glaucoma, one case of acute inflammatory glaucoma (the prodromal stage) and one case of chronic inflammatory glaucoma.

The first six operations (incisions with the Graefe knife, a broad needle or with the keratome) were performed in June, 1920 by Holth himself, the remainder, up to the present time, partly by my predecessor Professor Hj. Schiötz, and partly by myself. There has not been any selection of cases for this operation; during the above period the operation has been employed in nearly all cases where previously we should have performed Elliot's trephining. There was no case of glaucoma absolutum among our cases.

*Read at the Fifth Scandinavian Ophthalmological Congress at Stockholm, August 29, 1921.