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COMMUNICATIONS

AN UNTIED CONJUNCTIVAL SUTURE AND
CONJUNCTIVAL BRIDGE IN CATARACT EXTRACTION.
RESULTS AND CONCLUSIONS*

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EVEN a superficial study of the literature will convince one of the fact that ophthalmologists have been searching for a method by which a cataract wound can be quickly, safely, and securely closed, but we know by observation that few men employ a suture or a conjunctival bridge as a routine procedure, although they admit its value and attempt to introduce it after vitreous has been lost.

Apparently, Williams⁽¹⁾ of Boston was the first to describe the use of a suture in the cataract operation, first introducing a corneal suture after section, but later making a small conjunctival flap, and finding that by this procedure the wound could be more easily and satisfactorily closed. A similar procedure was advocated by Chisholm⁽²⁾ in the same year, and by Suarez de Mendoza⁽³⁾ twenty-two years later, although the latter rejected Williams' technique as too dangerous, and advocated that the sutures be inserted before making the section. Würdemann⁽⁴⁾ uses two conjunctival sutures after the section is made, if a conjunctival

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flap has been obtained, and the van Lint flap, if the section is in the cornea. The method of suture which has found the greatest popularity, however, is the one devised by Kalt⁽⁵⁾ in 1894. By his technique, the suture is placed in the cornea and sclera before the section is made, but it seems that one weakness of this method is that it provides no conjunctival flap. This objection appears to be met by the modification of Kalt's suture proposed by Ribas⁽⁶⁾ whereby the suture is placed in the conjunctiva and conjunctival flap. Kalt's method was used by Ellett⁽⁷⁻⁸⁻⁹⁾ with excellent results in the extraction of over 400 cataracts, and Moret⁽¹⁰⁾ strongly advised employment of the suture, because the end results were better. Schweigger⁽¹¹⁾, on the other hand, tried a corneal suture twenty-seven times, and then abandoned it because he had three cases of severe iritis, six of prolapse of the iris, and several cases in which there occurred attacks of keratitis.

Since the result of a cataract extraction depends in large measure on rapid and permanent closure of the wound, Maddox⁽¹²⁾ attempted to find some non-irritating cement for the wound. The application of newly melted wax proved successful in some cases but the results were not uniformly good, so that in 1911 he⁽¹³⁾ advocated insertion of two or three sutures to control loss of vitreous, for the promotion of healing and the prevention of infection. For piercing the sclera and drawing back the suture, he employed a discission needle having a fine eye.

An ingenious suture has been suggested by Frisch⁽¹⁴⁾, who formerly used through-and-through corneal sutures, but gave up that method because irido-cyclitis developed in several cases. The new suture is knotted at one end, and the needle is inserted in the cornea 1.5 mm. to the temporal side and 2.5 mm. below the upper corneal margin, emerging about 1.2 mm. above insertion, without entering the anterior chamber, and the thread is pulled through until the knot is in contact with the cornea. This suture can be placed lower if the operator prefers to have the incision terminate high in the cornea. The suture is carried from its corneal exit into the conjunctiva 4 mm. above the limbus, emerging 1.5 mm. above this. With the aid of a strabismus hook, the thread between the corneal and conjunctival insertion is pulled up to form a loop, 12 to 15 mm. long, so that the thread cannot interfere with making the section or obstruct delivery of the lens. After incision and extraction, the suture may be tied, leaving the knot *in situ* or eliminating it from contact with the cornea by traction on the corneal end of the suture and then making a new knot. He claims instantaneous control of the wound, prevention of vitreous loss after the cataract is out of the wound, and greater safety if a scoop must be used; also that the operation is not prolonged, for the suture can be inserted while waiting for anaesthesia of the iris.

The use of a conjunctival bridge was advised by Lamb⁽¹⁵⁾ in 1913, and by Cluckie⁽¹⁶⁾ in 1909, the latter saying "the broader and longer the conjunctival attachment to the cornea, the greater the chances for success and speedy recovery." Several operators have safeguarded their extractions by using a conjunctival bridge or by making an incision in the conjunctiva, undermining it, and making a subconjunctival extraction.

Bajardi's⁽¹⁷⁾ subconjunctival extraction is practically the same as Cluckie's operation, as the incision is made with a Graefe knife; in fact all these operations are really modifications of Czermak's⁽¹⁸⁾ subconjunctival extraction which was first modified and simplified by Dimmer⁽¹⁹⁾ in 1907. They both used a keratome in making the corneal incision, enlarged the opening with scissors, and, instead of making a conjunctival bridge, undermined the conjunctiva through an incision placed at some distance from the cornea.

Howard⁽²⁰⁾ stated in 1924, that he had given up using the conjunctival bridge described by him in 1923⁽²¹⁾ because of the fact that in swollen, mature, senile lenses, and in many immature cataracts, soft lens matter had to be left in the anterior chamber, owing to the small opening through which the lens had to pass. He now uses the sclero-conjunctival suture described by Verhoeff⁽²²⁾ with which he obtains excellent results, for there was no loss of vitreous in a series of one hundred extractions, many of which were intracapsular. Howard names three disadvantages in using a suture in cataract operations, two of which are overcome, at least in part, by the suture to be described. The first disadvantage named is the time required to introduce the suture, but it seems that this should not be of sufficient importance to be considered, when compared with the greater safety afforded by a suture. The second disadvantage is that the flap does not heal as smoothly as in an unsutured case; this objection does not seem to apply to the technique herein described. The third disadvantage mentioned is removal of the suture; Melville Black⁽²³⁾ considers this the chief objection because something like a second operation must be imposed upon the patient and the surgeon. Removal of this untied suture is a simple procedure, for one end is pulled after the other has been cut close to the conjunctiva. Wood⁽²⁴⁾ suggested the use of four or five day catgut sutures in order to obviate the necessity for removal, but catgut is difficult to manipulate. There are other more serious disadvantages than those Howard names; these will be considered later. He also speaks of the necessity for having an assistant; with the untied suture this is not essential. Many operators consider a suture unnecessary, but it apparently depends largely on the type of patient to be operated on whether or not a suture is required. Certainly, with the patients seen at

the New York Eye and Ear Infirmary, a suture is an added safeguard against many of the complications encountered in the cataract operation. Several authors speak of introducing a suture if vitreous is lost, but it is obvious that to attempt to introduce a suture, when the patient is restless and vitreous is actually escaping, is to select an inopportune time.

We believe the suture to be described possesses added advantages over the tied suture and conjunctival bridge, and has fewer of their disadvantages. A preliminary report in regard to the use of this untied suture in cataract extraction appeared several months ago⁽²⁵⁾. After submitting that report⁽²⁶⁾ two important changes in technique have been made, and additional experience has been gained.

Indications for Using this Untied Suture

We personally use the suture in every cataract extraction, but believe that it is certainly indicated in the following conditions:

- (1) Patients with one eye, particularly when the loss of the other has been due to haemorrhage.
- (2) Cataract complicated by glaucoma.
- (3) In all simple cataract extractions.
- (4) Where general anaesthesia is used.
- (5) Where there is tendency to squeeze, because, even though we can prevent this during the operation, squeezing may be disastrous during convalescence.
- (6) Where there is a tendency to cough, or where asthma or bronchitis are factors.
- (7) In operations upon the insane.
- (8) Where the lens is dislocated or subluxated.
- (9) Where there is fluid vitreous.
- (10) In the aged, where the recumbent posture and the prolonged use of adhesive dressings are contraindicated.
- (11) Where vitreous has been lost.

Contraindications

We know of no contra-indications, unless extreme atrophy of the conjunctiva may be considered as one.

Pre-operative Treatment

We believe that the pre-operative preparation is important, and realize the difficulty of carrying out any routine procedure. The method we try to adhere to and have used in most of the private patients operated on is the following:

A complete physical examination of the patient is made, including blood chemistry, examination of the sinuses, and in many instances roentgenograms of the sinuses, and the teeth. The

blood Wassermann test and urine analysis are made. A 0.3 per cent. solution of zinc sulphate is instilled in the eyes three times a day, and a 1 per cent. solution of mercurochrome - 220 soluble twice a day for one week prior to operating. For several days before the operation the patient is put on a light diet. A mild laxative is prescribed the day before, and an enema is given the morning of the operation. Thirty grains (2 grm.) of effervescent triple bromide are administered the night before the operation, and a hypodermic injection of codein phosphate is given three-quarters of an hour before starting the operation, providing there has been no trouble from the use of the codein when the preliminary iridectomy was performed. One drop of a 3 per cent. solution of atropin is instilled in the eye two hours before the operation. We have followed Bell's method⁽²⁷⁾ of using two drops of a 1 per cent. solution of silver nitrate in each eye one hour before, and a 25 per cent. solution of protargin mild just before and just after the operation, and we believe it to be of value in preventing post-operative infection. Lindner⁽²⁸⁾ has used Bell's method since October, 1923, and reports only one post-operative infection. He believes that most of the post-operative intraocular infections originate in the conjunctival sac, and therefore the saprophytes of the conjunctival sac and cornea must be responsible, usually pneumococci, staphylococci, and xerosis bacilli. His theory is that the silver removes the dead epithelium, and with it the saprophytes, and protargin mild inhibits the growth of micro-organisms in the first twenty-four hours after operation. For paralyzing the eyelids, we have followed Robison's⁽²⁹⁾ technique, and have found it most efficacious. An intradermal test is made with lens protein in all patients who have immature cataracts, as suggested by Verhoeff⁽³⁰⁾. If this test is positive the patient is desensitized before the operation. The lens substance may now be obtained from the research laboratory of Parke, Davis and Company, which greatly facilitates the work.

Technique of Operation

First Stage.—The suture may be partially or completely introduced before, but preferably after, making the corneal incision. A subconjunctival injection of 1 per cent. cocain solution with two drops of 1 to 1,000 adrenalin solution is made above the limbus, which facilitates the making of the conjunctival bridge. The conjunctiva surrounding the upper one-fourth of the cornea is then undermined with a special pair of scissors with long, thin blades,* working through a button-hole incision in the conjunctiva, 8 mm. above and 8 mm. temporal to

*These scissors and a special needle holder without a catch may be obtained from George Tiemann, 107 East 28th Street, New York.

the vertical meridian in the right eye, and 8 mm. nasal to the vertical meridian in operations on the left eye. It is preferable to use a needle holder without a catch. The suture used is No. 1 braided black silk impregnated with paraffin and is 40 cm. long. It is introduced by means of a small curved cutting needle, 3 mm. above the outer canthus of the right eye, or the inner canthus of the left eye, picking up a 4 mm. strip of conjunctiva. Another bite is then taken 1 mm. below the first. The loop thus formed is left long and drawn to one side. The needle is now introduced

FIG. 1.

Conjunctiva above the cornea undermined through a laterally placed button-hole incision.

horizontally, and engages a 3 mm. strip of conjunctiva. The points of entrance and exit of the needle are on opposite sides of the incision made for undermining the conjunctiva. The suture is now drawn to one side while the section is made.

Second Stage.—The cataract section is made in the limbus, leaving a conjunctival bridge in the centre of the corneal wound, which is as wide as possible and about 4 mm. long.

Third Stage.—The needle is now reintroduced and grasps a 3 mm. strip of the conjunctival bridge 1 mm. above the upper margin of the cornea, at right angles to the vertical meridian. The needle next grasps a 3 mm. strip of conjunctiva, 8 mm. above the upper margin of the cornea, 8 mm. nasal to the vertical meridian of the right eye, or 8 mm. temporal to the vertical meridian of the left eye. The suture then embraces a 3 mm. strip of the bulbar conjunctiva, 3 mm. above the inner canthus of the right eye or the outer canthus of the left eye. The needle is reinserted 1 mm.

below this bite, making a loop which is then drawn taut, fixing one end of the suture. The central part of the suture is usually

FIG. 2.

Cataract section completed leaving a centrally placed conjunctival bridge. Suture partially introduced.

FIG. 3.

Suture in place and central loop drawn to one side.

looped slightly and drawn to one side during the extraction of the lens.

Fourth Stage.—The conjunctival bridge is now cut above the suture by the special scissors and the lens is extracted. An attempt is usually made to extract the lens in capsule by means of Kalt's forceps, and if this fails, or the procedure seems too

dangerous, an attempt is made to obtain a large piece of the anterior capsule by means of Schweigger's forceps.

FIG. 4.

Conjunctival bridge being cut with Stevens' scissors, before the lens is extracted.

FIG. 5.

Wound closed by traction on suture while pillars are replaced and the anterior chamber is irrigated.

Fifth Stage.—In order to close the wound, the loop of the suture which was not drawn taut is pulled, as this controls the upper flap. It has been found practical to close the wound with the suture before irrigating the anterior chamber or attempting to replace the pillars of the iris, particularly in patients who are squeezing or are becoming restless.

Sixth Stage.—The lips of the wound may be approximated with the eyelids closed, and without further manipulation of the eyelids

FIG. 6.

Suture in place; lips of wound being sealed by iris forceps.

FIG. 7.

Eyelids closed showing suture in place and wound sealed.

or the eyeball. If the patient is sufficiently tractable the lips of the wound are sealed, as shown in Fig. 6, by pressing the edges together with toothed iris forceps. As the traumatism produced by the iris forceps and by the scissors is an excellent method for affecting early, firm closure of the wound, it makes unnecessary the search for some adhesive substance, as suggested by Maddox.

This procedure has been used for several years in closing other wounds, and is particularly useful in closing conjunctival wounds, after preliminary iridectomy and the de Wecker capsulotomy.

The suture may be passed through the lips of the wound two or three times, but it has been found most satisfactory to make only one bite. The suture ends are held in place on the nose and temple by means of collodion.

Post-operative Treatment.—No atropin is used after operation, but a light dressing is held firmly in place over both eyes by means of zinc oxide adhesive plaster, gentle pressure being exerted on the eye operated on. Ring's mask is used, and the eye which has been operated on is marked by a piece of adhesive tape, as suggested by Snyder. The patients are permitted to sit up in bed on the day of the operation, and are allowed out of bed the following day. The eye is dressed on the second day, and, if the wound has healed satisfactorily, the dressing is removed from the other eye. If the iris is not well dilated 3 per cent. atropin ointment is used. The eye is usually not dressed again until the fourth day, when the suture, if it is causing irritation, is removed by cutting one end close to the conjunctiva, and pulling the other, after the instillation of two drops of 1 per cent. phenocain solution at three-minute intervals.

The conclusions drawn in this paper are based on the study of 51 cases: 32 operated on by us, and 19 by other operators at the New York Eye and Ear Infirmary, through the courtesy of Doctor George H. Bell.

Of the 32 cases there were 18 mature senile, 7 secondary, 5 immature, 1 traumatic, and 1 incipient cataract; 4 were complicated by diabetes, 3 had uveitis, 6 had glaucoma, 2 had recurrent attacks of iritis, 1 had sinusitis, and 1 had chorioretinitis.

Twenty-nine were extractions after preliminary iridectomy, one was an extraction following a modified Lagrange operation, and two were simple extractions with peripheral iridectomy.

The complications during operation were as follow: In 3 cases the use of Kalt's forceps was unsuccessful and Schweigger's forceps was resorted to. A small amount of vitreous was lost in one case, because the patient looked up as the capsule forceps were being used.

Of the complications reported following operation there were 2 cases of uveitis, 4 of iritis, and 4 of keratitis. Soft lens matter was present in two cases, two patients had haemorrhages into the anterior chamber. A pillar of the iris was incarcerated in the case of a patient who persisted in squeezing and who got out of bed three times the night following the operation. Prolapse of the iris occurred in one of the two simple extractions; even though a peripheral iridectomy had been performed. This patient had

kerato-iritis for three months following the extraction, and the inflammation persisted until three alveolar abscesses which had been left following extraction of her teeth were curetted. The prolapsed iris had to be excised in this case.

Iris prolapse occurred then in 2, or 6.25 per cent. of these 32 cases, and 1, or 3.12 per cent. required operative intervention. Vitreous was lost in 1, or 3.12 per cent. of these cases, but there were no infections.

We were able to obtain post-operative records of vision with correction in 12 cases.

1. + 10.0 sph. + 0.5 cyl. $180^\circ = 20/20$ add + 4.0 sph. Jaeger 1.
2. + 1.0 sph. + 3.0 cyl. $180^\circ = 20/70$ add + 4.0 sph.
3. + 7.0 sph. + 5.0 cyl. $150^\circ = 20/50$
4. + 12.0 sph. + 2.0 cyl. $30^\circ = 20/40$
5. + 10.0 sph. + 2.5 cyl. $18^\circ = 20/40$
6. + 10.0 sph. = $20/70$
7. + 10.0 sph. + 3.5 cyl. $165^\circ = 5/200$
8. + 10.5 sph. + 1.5 cyl. $30^\circ = 20/30$ add + 3.5 sph. Jaeger 1.
9. + 10.0 sph. + 4.5 cyl. $30^\circ = 20/20$ add + 5.0 sph. Jaeger 1.
10. + 10.0 sph. + 4.5 cyl. $180^\circ = 20/20 - 1$
11. + 9.0 sph. + 2.0 cyl. $180^\circ = 20/70$
12. + 10.5 sph. + 2.0 cyl. $175^\circ = 20/30 + 2$ add + 4.0 sph. Jaeger 1.

Of the 19 cases operated on by other operators there were 13 mature senile cataracts, 2 immature cataracts, 1 posterior cortical cataract, and 1 complicated cataract.

One case was complicated by diabetes and 1 by glaucoma. There were 16 extractions after preliminary iridectomy, and 1 combined extraction. Loss of vitreous was reported in 5 cases. The complications after operation were soft lens matter in 3 cases and striate keratitis in 1 case.

The 7 post-operative records of vision with correction were as follow :

1. + 11.0 sph. + 1.0 cyl. $180^\circ = 20/40$ add + 4.0 sph. Jaeger 1.
2. + 10.0 sph. = $20/40$ add + 3.5 for near.
3. + 10.0 sph. + 1.0 cyl. $180^\circ = 20/30$ add + 4.0 for near.
4. + 8.0 sph. + 1.5 cyl. $10^\circ = 20/50$
5. + 3.0 sph. + 2.0 cyl. $15^\circ = 20/70$
6. + 10.0 sph. + 2.5 cyl. $180^\circ = 20/40$
7. + 12.0 sph. + 0.75 cyl. $15^\circ = 20/20 - 3$ add + 3.0 for near.

There was loss of vitreous in 5 of the 19 cases operated on by other operators, all resident surgeons of the New York Eye and Ear Infirmary, or 26.3 per cent., but there was no prolapse of iris and no infection.

There was loss of vitreous in 6, or 11.7 per cent. of the 51 cases, and prolapse of the iris in 2, or 3.9 per cent. of the cases. There were no infections.

Although the percentage of vitreous lost by the resident surgeons was high the results were good. It is our belief that the presence of the suture prevented greater vitreous loss in several of the cases and permitted the completion of the operation with careful replacing of the iris pillars and closure of the wound by iris forceps.

Advantages of a Suture in Cataract Extraction

(1) The secondary membrane is not apt to be as dense with a suture as without one, for the anterior chamber is restored early. In several cases an appreciable anterior chamber has been seen within a few minutes, as 0.5 per cent. normal saline solution is used to irrigate and fill the anterior chamber, and the lips of the wound are sealed by iris forceps. The rapidity with which secure closure of the wound may be effected makes one feel safe in removing all the soft lens matter.

(2) It was believed that the amount of post-operative astigmatism was diminished, and Clark⁽³¹⁾ has found this to be true for the conjunctival flap without a suture; but further experience leads us to believe that the suture had little if any influence in reducing the amount of astigmatism except indirectly by making post-operative complications less likely to occur.

(3) Loss of vitreous is sometimes prevented. If loss of vitreous has occurred or is feared the wound may be closed immediately.

(4) Iris prolapse is usually prevented. The anterior chamber is quickly restored and the wound firmly closed.

(5) The danger of infection is diminished. As the wound is quickly closed the danger of infection by direct extension from the conjunctiva is lessened, and as the complications of vitreous prolapse, eversion of the cornea, and prolapse of the iris are uncommon, the danger of infection from these sources is also diminished.

(6) The period of convalescence is reduced, since the complication of delayed wound closure is seldom seen as most of its causes are eliminated, and wound healing is accelerated by the close approximation of the wound edges.

(7) Eversion of the cornea after operation is prevented, and if it occurs during the operation it can be corrected easily by traction on the suture.

(8) The occasional total loss of an eye is probably prevented. In patients, normally sane, who become violent after operation, and particularly in insane patients and those who vomit following operation, the loss of an eye may possibly be avoided.

(9) Post-operative discomfort from gas and posture is lessened. The patients are allowed a back-rest or pillows immediately after operation and are permitted to be out of bed the following day.

(10) Post-operative delirium is reduced to a minimum. The patient may be given the partial use of the other eye the day after operation. This is done by cutting a small hole in the Ring's mask permitting vision above the horizontal plane.

(11) If vitreous has been lost the wound lips may be drawn tightly together, squeezing out the vitreous from between the cornea and sclera, thus permitting the wound to heal more rapidly.

(12) A suture is of greatest value in an operation in which a general anaesthetic must be given, for patients who squeeze and cough, and in operations on the insane. In patients who have glaucoma and cataract, or who have lost one eye, a suture is certainly indicated.

Added Advantages of an Untied Suture and Conjunctival Bridge

(1) The wound may be closed rapidly by a single motion, even when the patient is squeezing, the speculum has been removed and the eyelids are closed; this is also true with Frisch's⁽¹⁴⁾ suture.

(2) The ends of the suture are held out of the field of operation by conjunctival fixation.

(3) The suture may be removed with ease, it being necessary to pull only one end of the suture after cutting the other close to the conjunctiva.

(4) There is no knot and there are no loose suture ends, which frequently irritate the conjunctiva and sometimes the cornea.

(5) The suture is not in the operative field while the section is being made, for protection is provided by the conjunctival bridge. Some operators prefer to introduce this suture before the section is made, but we have found that the conjunctival bridge affords sufficient protection.

(6) The suture may be drawn taut, closing the wound at any time during the operation, and may be easily loosened. As the suture is easily controlled, permitting the wound to be opened and closed, the anterior chamber may be irrigated and the iris pillars replaced while the wound is partly closed. These two points are also true with Frisch's suture.

(7) A large conjunctival flap is always easily obtainable even though a preliminary iridectomy has been performed.

(8) As the wound is held closed by the suture, and the conjunctival flap is sealed by iris forceps, iris prolapse is a rare complication, even though vitreous has been lost.

(9) If vitreous has been lost and a loop or spoon must be used the ease with which the wound may be opened and firmly closed has apparently prevented greater vitreous loss.

Disadvantages of a Suture in Cataract Extraction

(1) One or two minutes are added to the time of operation.

(2) The suture may produce slight irritation, particularly if a knot and loose ends are left. This disadvantage is minimized by the untied suture.

(3) It is difficult and sometimes dangerous to remove a suture in certain intractable patients, even though it is left in for ten days. This difficulty is also reduced to a minimum by the untied suture.

(4) The section is made more difficult owing to the presence of the suture loops and ends. This disadvantage is absent in the untied suture, for a bridge of conjunctiva is left for protection, and the suture is only partially introduced until after the section has been made.

We believe the following conclusions are justified :

(1) The advantages of using a suture in cataract operation outweigh the disadvantages.

(2) An untied suture and conjunctival bridge combine the advantages of a tied suture and conjunctival bridge, and we believe that the disadvantages are minimized or eliminated.

As authors agree that a suture is of value if vitreous is lost, why not have a suture in place before this accident occurs?

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