CONNOR (L.)

The Technique of Tenotomy of the Ocular Muscles.

Read in the Section on Ophthalmology, at the Forty-sixth Annual Meeting of the American Medical Association, at Baltimore, Md., May 7-10, 1895.

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REPRINTED FROM THE
JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION.
NOVEMBER 2, 1895.

CHICAGO:
AMERICAN MEDICAL ASSOCIATION PRESS.
1895.

THE TECHNIQUE OF TENOTOMY OF THE OCULAR MUSCLES.

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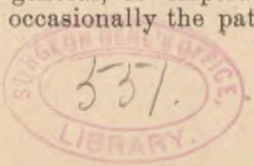
It is desirable that both patient and operator be in good physical condition. The surgeon, his assistant, patient, instruments, and operating room should all be rendered as aseptic as possible, because asepsis is the fundamental principle of modern surgery, which no ophthalmologist can afford to disregard, even when doing an ocular tenotomy. The operator's hands should be washed with pure soap and hot water, by the aid of a hand brush, so as to loosen all bacteria and other infectious materials lodged on the skin, attached to the hairs, embedded in the mouths of the oil or sweat glands or under the finger nails. This loosened *débris* is best removed by running hot water. The face, and beard (if the operator have one), are cleansed with scrupulous care. When dried, the hands are soaked in bichlorid solution, 1 to 1000. The assistant and patient cleanse themselves in a similar manner. Especial care is taken to free from all septic material the edges of the eyelids, lacrymal passages and conjunctiva by washing with the bichlorid solution. The instruments are to be sterilized in steam or boiling water, and just before using, soaked in absolute alcohol, dried and laid upon an aseptic tray. The room freed from all infection should afford adequate light, as the best work is impossible unless the surgeon can see distinctly each step.

An anesthetic, local or general, is imperative. Usually cocain suffices, but occasionally the patient



is so uncontrollable as to compel the administration of a general anesthetic—ether, chloroform or methylene bichlorid. The surgeon's personal views, determines his selection of the anesthetic. Unquestionably, chloroform is more dangerous, but it is more pleasant to both patient and operator, and I do not recall a death from an ocular tenotomy done under its influence. The instruments needed are: a speculum; lid retractor; fixation forceps; fine toothed forceps; a blunt pointed scissors curved on the flat; tenotomy hooks; fine needles and fine silk sutures; sterilized absorbent cotton and bandage.

The several steps of the operation are: 1, the opening of the conjunctiva; 2, opening the capsule of Tenon; 3, lifting the tendon from its sheath; 4, division of the tendon; 5, dressing of the wound. It is improbable that any operator takes these steps exactly as any other, but all open the conjunctiva and capsule, divide the tendon and dress the wound in some manner. Some open the conjunctiva and capsule at the lower edge of the tendon and parallel to its fibers; some at the center of the tendon and in the same direction; some at right angles to the tendon fibers, either at their outer edge, at their center or along the entire line of their insertion; some make the opening large, others of medium size, and others small. Some divide the tendon subconjunctivally, others partially so, and others openly. Some unite the edges of the conjunctiva with fine silk suture; others leave the wound entirely open. Some use forceps to lift the tendon for division by the scissors; others use the blunt hook of various shapes; all however use either forceps or blunt hook. Doubtless each surgeon, by more or less unconscious experiment, finds the method suited to his personal equation, and adopts it, as giving him the best results. The end sought is the division of the tendon close to its insertion, without unduly disturbing the adjacent tissues.

Some surgeons dress the wound by putting a few drops of boric acid solution into the conjunctival

cul-de-sac, then a bit of linen moistened in bichlorid solution on the closed lids, then a bit of borated cotton and, finally, a bandage over all; others after cleansing the conjunctiva, simply close the lids with isinglass adhesive plaster; others leave the eye entirely open, after the effects of the cocain have disappeared; others protect the eye from light, dust and wind with a blind, and have the eye soaked in hot water at regular intervals, to hasten repair and relieve discomfort. Good results attend any of these variations in operating or dressing, at the hands of a skillful operator. While unable to discuss their merits or demerits, the open dressing commends itself because it best utilizes the vision of the squinting eye in fixing the eyes in the best position while re-attachment of the divided tendon is taking place. If the operation be done aseptically the wound should be carefully closed by suture, unless from its small size and horizontal direction there is no necessity to exclude air after the effects of the cocain have disappeared.

In estimating the effects of a tenotomy we must consider: the weakened power of the muscle operated upon; the muscular force of its antagonist; and the elasticity of the tissues—factors which vary greatly in individual cases. Roughly, the force of the muscles can be determined by the degrees to which they are able to turn the eye in the direction of their long axes, during their greatest contraction. This motility affords a sound guide in estimating the effects of a tenotomy. Thus, if the motility of the muscles be unchanged, clearly the operation is ineffective and the cause must be searched for and removed.

To operate intelligently, the surgeon must, first, measure the extent of the strabismus; and to know his results he must repeat his measurement after the tenotomy. The best means for making such measurements are the use of prisms, producing double images at 6 or 7 meters. The difficulty with this

method, lies in the fact that not all squint eyes possess sufficient vision to render it available. Such cases compel the surgeon to select a method applicable to them. The varieties of these are legion. Some operators depend entirely upon their own eyes, both in measuring the amount of squint, and the perfection of its correction. Others mark with an ink dot, the position of the center of the pupil or edge of the cornea of the squinting eye, on the edge of the eyelid, both in the squinting and fixing position—the space between the two dots roughly measuring the deviation. The strabismometer, with others takes the place of the ink dots. In Graefe's method, the flame of a candle is fixed by the squinting eye at a distance of 5 meters, and the zero point of the scale brought beneath the corneal image of the flame. Then the fixing eye is arranged for the same flame, and we note how far from the middle of the pupil the squinting eye has deviated from zero. The observer should be in the visual axis of the squinting eye, while making his observation. The secondary variation of the fixing eye is measured in the same manner. Of the many other methods, by perimeters, tapes, boards, etc., we can not speak.

In my own work, the following technique has proved satisfactory: the vision of each eye is carefully noted, all ametropia, ascertained under atropin, fully noted, if such correction will diminish the strain upon the weaker muscles, The power of the several muscles is measured, all defects being accurately recorded. The method of ascertaining the amount of squint is selected according to the character of the case, always when possible utilizing prisms. The operation is planned, so that there will remain a slight convergence immediately after the tenotomy of the interni or externi; but in vertical squint I aim to undercorrect. In all cases it is sought to secure such motility of the muscles as will so obviate their defects as to enable them to center the visual lines upon an object within the fields of vision. The ac-

complishment of this frequently calls for the division of the operation between the muscles of the two eyes, even though an operation on one might make the eyes straight. The instruments used are a pair of scissors, curved on the flat, both points blunt, blades narrowed near their ends, firm enough to divide the tendon without springing, and so nicely adjusted as to cut the tissues to their very ends. The forceps are delicate, yet sufficiently strong, that they readily grasp and hold firmly the tendon. The blunt hook is curved nearly at a right angle and quite small, as it is used to lift but half of the tendon at once, because I operate from the center toward either side. The speculum and lid retractor are unimportant, if only they afford an unobstructed view of the field of operation, and cause the patient a minimum of discomfort. The lid retractor in the hands of a good assistant, is especially convenient when operating upon the superior or inferior recti.

The fixation forceps is rarely called for, except in cases requiring a general anesthetic, because under cocain the patient is able to hold the eyeball in the correct position. These instruments are sterilized, dried, soaked in absolute alcohol, wiped and placed on a clean tray just before using.

The patient lies in a half reclining chair, facing a good light, with head wrapped in towel moistened in bichlorid solution, and clothes covered with a clean apron to the neck. The operator, assistant and patient have been rendered aseptic by the method described.

The cocain solution, 4 per cent., made with distilled water and 16 grains of boric acid to the ounce, is dropped in the cul-de-sac of the eye to be tenotomized, repeated every few moments till the conjunctiva has become insensible, and during the several stages of the operation, as the case demands.

The assistant steadies the patient's head, prepared to remove with absorbent cotton any hemorrhage which may obstruct the field of operation.

In tenotomy of the internus, the operator sits or stands, facing the patient, who is directed to turn the eyeball strongly outward; the conjunctiva is seized with the forceps, so as to make a small vertical fold, directly over the insertion of the tendon. With the scissors this fold is divided, making a short horizontal opening of the conjunctiva. Through this opening the forceps grasp the tendon sheath forming a vertical fold similar to that made in the conjunctiva; this fold is divided, thus laying bare the tendon, which is seized by the forceps so as to make a horizontal fold, and by slight traction from the eyeball, exhibits its insertion. The division of this fold close to the sclerotic, by the scissors, makes a central opening into the tendon. The fibers on either side are now severed, by placing one blade of the scissors beneath, and one above the tendon but below the conjunctiva, and closing the blades one or more times as may be needed. Usually this can be done completely by the scissors alone, but if it fails, the little blunt hook is made to enter the wound in such a manner as to catch stray attachments, and permit their division with the scissors. The motility of the eye outward is now examined; if it equals that of the other eye, enough has been done, but if it retain the same motility as before the operation, then the occasion needs to be sought and removed. The behavior of the eyes when fixed upon an object at one-sixth of a meter or less is important; if they diverge, we know that the effect is too great and must be limited by suture. If they converge as before the operation, the tenotomy has been imperfect; but if the eyes remain steady or slightly converged, the result will be satisfactory; or, still more certainly, if, when tested by prisms, at 6 meters, the eyes maintain a condition of vertical equilibrium—the misplaced arc of movement of the squinting eye has been replaced in its normal position.

But if the tenotomy has failed to adequately reduce the convergence, we have several courses of

procedure; doing of a tenotomy on the other eye; severing more or less freely the attachments of the muscle or muscles; the use of sutures; advancement of the weaker muscle; or increasing the relative power of the defective muscles as in insufficiencies. In convergent squint I have never had occasion to use a suture to increase the effect of the tenotomy. In tenotomy of the externus, the eyeball is turned strongly inward in the horizontal meridian; the conjunctiva grasped by the forceps at about 7 millimeters from the external border of the cornea and the other steps taken as when operating upon the internus. About 2 degrees may be gained by a simple tenotomy of the externus, though this is uncertain and likely to diminish after a time. The use of sutures from the superficial fibers of the sclerotic, at the inner sclero-corneal junction, to the inner commissure, will enable the surgeon to greatly increase this effect. If both eyes be tenotomized, the sutures may be tied over the bridge of the nose, and the divided ends of the tendons made to unite with the sclerotic as far back as desired. I prefer the advancement of the weaker muscle to the use of sutures in divergent squint.

In tenotomy of the superior rectus, the eyeball is turned downward as far as possible, so as to bring its insertion fully in view. The assistant by a lid retractor lifts the upper lid, the conjunctiva is opened at about 8 millimeters from the corneal margin, and the further steps taken as in the other tendons. The insertion of this tendon is near that of the superior oblique, and slants outward and backward, points worthy of remembrance during the tenotomy. Tenotomy of the inferior rectus is done in the same manner as that of the other tendons, the insertion being about 7 millimeters from the corneal margin.

After each operation the position of the eyes, and the motility of the muscles are carefully studied, so that if the effect be insufficient it may be increased by some available method, or if it be too great it may be restricted.

The opening into the conjunctiva is so small and so located that it usually closes sufficiently without suture. The conjunctival cul-de-sac is cleansed with boric acid solution; the eye protected from light by a shade until the effects of the cocain have passed away, and then left open. The patient is directed to soak the eye in very hot water frequently, to relieve discomfort and promote repair of the wound.

An ocular tenotomy, done after the manner described, is nearly painless and bloodless, absolutely free from any danger, involves the least traumatism; gives very definite results; requires no after dressing; and secures binocular vision, if this be possible by a tenotomy.

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