

Oxford units of penicillin in a 5 per cent. solution of dextrose were given intravenously within the first twelve hours. The temperature immediately dropped to 103°F. and the child began to improve, and was afebrile after seven days. During fourteen days 975,000 Oxford units were given.

On October 15, in spite of striking clinical improvement with diminution of proptosis, the blood on culture still yielded haemolytic staph. aureus and sulphadiazine was started by the mouth. On October 20 the blood was sterile on culture.

On October 19 the condition was as follows:—subsiding bilateral proptosis, dilated superficial veins, ptosis of left upper lid, paralysis left external rectus, paresis right external rectus, pallor of both optic discs, bilateral macular oedema with engorgement of retinal veins. There was no vision at all in the left eye, but with the right eye he could distinguish objects at two feet.

On November 2 the patient was discharged in excellent general physical condition except for left foot-drop, complete ptosis of left upper lid, bilateral paralysis of external recti, and bilateral atrophy of the optic nerves. Later the left ptosis disappeared and the recti paralyses had greatly improved. It is not stated that there was any improvement of the visual acuity.

A. F. MACCALLAN.

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## CORRESPONDENCE

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### STRABISMUS OPERATIONS

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*To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.*

DEAR SIRS—The letter which appeared in the April, 1944, issue of the *British Journal of Ophthalmology*, written by Mr. J. W. Killen, of Londonderry, as of February 22, 1944, contained so many statements with which I disagree that I must not permit it to remain unanswered.

Mr. Killen states that the usual operation of advancement and recession for strabismus "must leave an eye with a mechanically imperfect mechanism for co-ordination, except when looking forward in the horizontal plane, and that the insertions of the muscles should remain in their natural positions." (I presume he is discussing convergent strabismus.) It is difficult to understand his statement. A proper advancement, with or without the resection of a tendon, does not change the position of the scleral insertion. The scleral insertion of, and the arc of contact of the muscle to the sclera, with the enveloping sheath of Tenon's capsule, have, following the surgery, a natural position. It is understood that a logical resection and/or advancement of a muscle tendon includes simultaneously the enveloping sheath of Tenon's capsule.

The advancement which Mr. Killen has diagrammed actually shortens the arc of contact of the advanced muscle and gives during healing a very insecure and easily displaced new position for the advanced tendon. He permits a stump of tendon to remain attached to the sclera, attaching the resected tendon to the natural insertion of this. Such a tendon re-attachment is certain, even if the

capsule sheath is meticulously spared, to result in a posterior-ward, cicatricial scleral adhesion of the cut end of the retained stump, including at the same time the overlying advanced tendon, and thereby causing the situation which he states is best prevented.

The advanced portion of his shortened tendon overlies the retained stump. If he reversed this, and brought his advancing tendon beneath the retained stump, conserving his capsule at the same time, then many of the objections to his operation would disappear. I am sure, however, that if this were the sequence of steps by Mr. Killen in operating, he could hardly resist converting it into a satisfactory operation by resecting that useless stump and changing his surgery thereby to a simple muscle resection. In 1935, and again in 1940, several of us were doing some rather extensive experimental glaucoma and corneal surgery on the rabbit. In some of these operations, it was thought necessary to have perfect fixation of the animal's eyeball through muscle fixation with muscle sutures, and in several instances with tenotomies to obtain relative immobility of the globe. Because all of these surgical procedures were to be checked by subsequent enucleations, it was natural for us to add to these basic procedures the technique of various forms of ocular muscle operations. Practically all operations in existence, good and bad, were done to satisfy curiosity, if for no other reason. Some of the postoperative findings were seen sufficiently often that one could logically consider them the sure result of certain procedures. Haemorrhages into a muscle always were followed by fibrosis and underlying as well as overlying adhesions. Cut ends of muscles, when sutured to the sclera, regardless of whether or not that suture line followed rational and physiological anatomical rules, remained adherent to the sclera at that point of suture. Muscles sectioned incompletely in various ways (some not unlike the incision lines which Mr. Killen uses for his internus) showed later considerable scar tissue, overlying cicatricial adhesions, and all degrees of underlying muscle and sclera adhesions, these depending, naturally, upon the extent of muscle damage. Muscles which were shortened by laps, folds, plications, and tucks always seemed to stretch, and showed later results so variable in degree and in amount, that such surgical procedures as deliberately planned operations are not good. Tenotomized muscles, completely or incompletely sectioned in the rabbit, always re-attach themselves somewhere to the sclera. These notes, as quoted, were only incidental to a different study, but they were rather conclusive, though too haphazard for any report except a relevant mention as is made now.

The use of stitches into the sclera is not a tragedy; instead it is a procedure of tremendous advantage and of great desirability. If one cannot introduce sutures into the sclera, even over the ciliary body, without endangering the ciliary body, then that person should do no ocular surgery whatsoever.

The tenotomy which Mr. Killen recommends for the internus is not without controversy. If the entire muscle tendon is not detached from the sclera by way of a complete tenotomy preparatory to a recession, there can be but little change in the position of the anterior-posterior axis of the globe. This is a basic requirement in operating for convergent strabismus. Weakening the adducting power of an internus is not the surgical cure for strabismus. The central strand of the tendon which he leaves intact will not modify the effective motion of the eyeball through the muscle action applied to that tendon as long as an intact tendon attachment remains, no matter how slight that may be. The lateral incisions which he has recommended, being in the tendon and muscle, will become re-attached, in a fan shape, to the sclera and thus shorten the arc of contact, limiting the effective action of the muscle, to be true, but doing it only through chance to an unpredictable amount in each individual case. That which is most objectionable, however, is, by reason of this shortening of the arc of contact of that tendon through cicatricial healing, one will most certainly limit as well the total adduction excursion of the eyeball after recovery. A recession will obviate every one of the defects resulting from Mr. Killen's recommendation and will, at the same time, enable one to determine with exactness the degree of posterior tendon displacement desirable permitting thereby medial and lateral rotations of the line of vision without secondary unwanted and intangible cicatricial adhesions and without limiting the necessary prism adduction needed for the patient's comfort

thereafter. It has been proven that a central intact strand of tendon, such as Mr. Killen recommended, does not subsequently stretch. It cannot because it becomes adherent to the sclera.

There are so many factors which modify the surgery of squint, intangible as well as tangible, that one cannot speak of weakening a muscle or strengthening a muscle, *i.e.*, a "mechanically imperfect mechanism," to obtain a new position for the visual line any more than one can say a recession or an advancement of a certain number of degrees means a certain fixed change in the arc of the converging visual axis a subsequent number of degrees—as though one were opening or closing a perfectly hung door a certain amount at will. Ocular muscles are "too short" only when fibrosed as a result of secondary contractures, as a mesodermal aplasia, as one sees them with a retraction syndrome, or when contracted as a result of a long-standing direct antagonist paralysis. The cause of strabismus lies largely in a developmental defect wherein that conditioned reflex which we speak of as singular binocular vision has been imperfectly developed due to either sensory or motor obstacles, or both, as was so ably outlined by Chavasse. It is only in those instances mentioned above that one can find an actual fault in the anatomy of the muscle itself, either in its length, its strength, or its structure.

The degree of visual acuity present in the strabotic eye, the duration of macular suppression, the extent and quality of abnormal retinal correspondence, the amount of fusion training which antedated the surgery, the amount of hyperopia present, and associated convergence-accommodation relationship—even the age of the patient, are factors which must be considered individually when each case comes to the operating room for initial or final correction. We know that the surgery alone is never the entire treatment of a case; it can only be one step in the necessary medical and surgical therapy essential for best results.

Mr. Killen closes the conjunctiva over the "shortened" tendon with a purse string suture, stating that it is unnecessary to cover the conjunctiva over the "lengthened" tendon. It seems that it would have been better to have used no suture whatsoever than to use a purse string suture. It is necessary to close a conjunctival wound overlying an ocular muscle. Cicatricial lines and adhesions in the conjunctiva are always to be avoided for cosmetic as well as physiological reasons, and they cannot be prevented unless the incision lines are properly closed. If an operation for squint is necessary, the result should be the most perfect which can be obtained. It takes but a very few minutes to introduce a running suture to close an incision line adequately and satisfactorily.

It is difficult to understand the statement that an "advancement and recession must leave an eye with a mechanically imperfect mechanism for co-ordination, except when looking forward in the horizontal plane." Such surgery certainly cannot modify the vertical ductions in any way whether the eyes are to the front or bilaterally rotated to either side. The reattachment of the muscles to the former tendon positions cannot affect torsion in the eyeballs, regardless of their anterior-posterior position. The two operations mentioned and protested permit co-ordination, a faculty which was wanting prior to the surgery. They do this by changing the former converging axes to a position approaching more nearly parallelism, without changing the muscle arcs of contact, *i.e.*, the amplitude of rotations of the transplanted tendons. At the same time the recession when indicated because of preponderance in convergence (a convergence excess) corrects without decreasing the degree of prism adduction needed after the surgery, at the same time permitting full rotational convergence. The degree of correction obtained at the end of the surgery is, within the limits of strabismus surgery, predictable, a logical deduction as to the result. The post-operative binocular correspondence of the mosaic of retinal macular cones is an essential. This is emphasized in our desire to carry out pre- and post-operative orthoptic exercises; and also illustrated by our treatment of suppression, amblyopia, and abnormal retinal correspondence.

The necessity for a recession with or without a resection depends only upon that degree of strabismus which is the result of the subtraction of the total measurement of the squint for near by that amount of the squint remaining at distance when the patient is atropinized. The difference between these two is the accommodative factor present in a case and is not to be surgically corrected. If,

for example, a patient has 35 deg. of monocular convergent strabismus at near, without atropinization, and under full atropinization he has none whatsoever for near or distance vision, the squint formerly present is certainly not an operative situation. If, however, he has 25 deg. of residual squint at distance under atropinization, and none at near, about 1/3 of his squint was an accommodation-convergence attribute. The surgical amount to be corrected is 25 deg., and the optimum attack would be upon the external recti, bilaterally, perhaps. The accommodative factor should be treated by other means than through surgery. The amount of squint caused by excess convergence, if corrected even temporarily by accommodation relaxation as through atropinization, may rarely demand surgical correction. It is necessary, however, before this is done, that every other logical form of therapeutics be utilized.

When pre-operative adequate atropinization fails to change the degree of squint for near and/or distance, surgery is most necessary considering all types of squint. At the same time, this type of strabismus demands most careful balanced surgery to the internal and external recti. Those with an adduction disproportion are to have the greater amount of attention paid to recessions. Those in which this proportion is missing must obtain the greatest amount of correction through an advancement with a resection.

The greater the convergence excess factor with accommodation paralyzed in any given case, the more necessary is a full, clean, and adequately controlled recession—the partial tenotomy as presented by Mr. Killen cannot correct the underlying situation; actually it must leave the patient with the mechanically imperfect mechanism he deplors.

The earlier one can operate in a child's life, the better. One, however, must be certain, that surgery is indicated, and the type of surgery necessary. A good cosmetic appearance is not the reason for operating. Normal to improved visual acuity and single binocular vision are the results hoped for. True, surgery is a valuable form of orthoptic treatment, but only a single form of such treatment.

The oculo-motor dynamics connected with single binocular vision, when consummated and functioning, are fortunately much better known than is our knowledge of the development of these co-ordinated conditioned reflexes which constitute single binocular vision. If mechanical principles are considered, all forms of oculo-motor surgery will at least be of benefit; and undoubtedly this is the single underlying reason for the contribution sent you by Mr. Killen. My sincerest respects to him for his desire to keep the surgery of squint upon a sound physiological and anatomical basis. It is most laudable. Individual and creative deliberation are not too common during these tragic days.

I should, perhaps, apologise for my vehemence, as above, but I do want for the coming younger men in ophthalmology the inheritance of professional unanimity, when the basis for therapy can be without confusion.

Yours truly,

EDMUND B. SPAETH.

PHILADELPHIA,  
August 19, 1944.

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## NOTES

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North of England  
Ophthalmological  
Society

THE following is a list of the dates of this Society's Meetings fixed for the coming Session: Leeds, Saturday, December 2, 1944; Newcastle, Saturday, February 17, 1945; Liverpool, Saturday, March 17, 1945; Sheffield, Saturday, April 21, 1945; Bradford, Saturday, May 12, 1945.