IT is a far cry from the day when von Graefe could describe the oblique muscles as the "noli me tangere" of ophthalmic surgery.19

Landolt’s myectomy (tenectomy) of the inferior oblique has become commonplace, while tenotomy20, recession8 and resection17 of this muscle are all performed with success. Terrien has even divided its motor nerve16 supply.

Operations on the superior oblique though less common, are still well known. Examples of this are Wegner’s reconstruction of the trochlea after injury18, Hughes recession of the trochlea for overaction10, and transplantation of the superior oblique for IIIrd nerve paralysis15.

On the other hand, recession of the muscle for overaction or advancement for paresis appears to be relatively rare. Jackson 190313, for example, treated such pareses by transplanting the superior rectus further backwards and outwards—a technique employed as late as 1932 by Barrière.1

While Wheeler19 invented a technique of superior oblique advancement, and operated successfully by it on five cases in 1935, Gifford wrote six years later6 as follows:—

“I have not been courageous enough to recess the inferior oblique or to advance the superior oblique as Wheeler described. On account of the extensive insertion of these muscles in areas far back on the globe these operations must impress many ophthalmologists as exceedingly difficulty of execution.”

Gifford, like Gibson, in the same year, advocated tenotomy of the ipsolateral antagonist, and contralateral synergist, and employed this technique in six cases of superior oblique paresis.

Since then, I have found only one recorded case, that of Borley and Renaud2, though Professor Franceschetti told me during a recent visit to Geneva that he has several successful (unrecorded) cases.

The relative rarity of direct operations on the superior oblique tendon, has therefore prompted me to add three to their number. I am obliged to Mr. E. C. Pemberton for the synoptophore and diplometer readings with comments, and to Mr. Claude Jellings for the photographs of the patient, the operation, and the diplometer charts.

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Advancement of the superior oblique with tenotomy of the inferior oblique

Case 1.—The patient, a machine shop foreman, aged 36 years, developed concussion in 1937, from a blow on the forehead in a motor accident. As far as could be ascertained at a later date, the blow was well above the orbital margin.

From that time forward, a paresis of the left superior oblique gave him vertical diplopia in the whole lower field, accentuated by looking to the left. The central vision was normal in both eyes, and $14^\Delta$ of left hyperphoria were present in the primary position.

He accepted an $8^\Delta$ correcting prism which reduced the symptoms slightly, and was given three courses of orthoptic exercises in the next three years.

In January, 1943, he stated the diplopia bothered him increasingly, and therefore in July, 1943, a partial tenotomy of the right inferior rectus was performed. I suspect that fear that over-tenotomy might increase the diplopia in the important lower field, and the restraint exercised by secondary attachments of the muscle to the lid and inferior oblique led to a disappointing result in this, as in one previous and one subsequent case in which I employed it.

Certainly no change occurred in the measured deviation, and from this date he could only work with the left eye occluded.

In January, 1946, the position was unaltered. He still had poor movement of the left eye down to the left as shown in the photograph Fig. 1. At the horizontal level he had $12^\circ$ of L. ex-cyclophoria at all angles, and the other synoptophore measurements were as given below:

- Straight ahead $= -1^\circ$ L/R $11^\Delta$
- $20^\circ$ to R. $= -1^\circ$ L/R $27^\Delta$
- $20^\circ$ to L. $= 0^\circ$ L/R $1^\Delta$

The cyclophoria is also well shown on the diplopia charts of the primary and secondary deviation, Figs. 2a, 3a. These were self-recorded on a device (the diplometer) whose design is as yet experimental, but which utilises complementary colours in the same way as the Hess screen, and the Lancaster projection lamps. The fixation is therefore macular, and the strips represent the actual position of the eyes and not of the false images.

The fixation distance is 25 cm. and the maximum field of $15^\circ$. This area was chosen as the head begins moving in a normal person if the eyes move beyond $12^\circ$ from the primary position.

Operation, February 16, 1946. Under a retrobulbar anaesthetic the left inferior oblique was tenotomised close to the globe by the approach used by Dunnington, and later White and Guibor. The technique described by Wheeler was employed to expose and advance the superior oblique. This proved to be
FIG. 1.

Eight years' paralysis of the left superior oblique.
Prior to operation.
Note failure of movement down and to the right.

FIG. 2a and 2b.

Paralysis of superior oblique after tenotomy of ipsilateral inferior oblique & advancement of ipsilateral superior oblique. Note slight weakness of left superior rectus & disappearance of cyclophoria.
Certain Operations on the Superior Oblique

FIG. 3a and 3b.

The hook is under the superior oblique. The thread on the left is through the stump of the superior rectus. The thread held in the forceps is through the free end of the superior rectus.

FIG. 4.—Exposure of the Superior Oblique.
surprisingly large, and the overlying superior rectus (which was divided) rather thin. A double-armed catgut suture was inserted through the tendon about 6 mm. from the insertion, and this point was attached to the episcleral tissue of the globe in the line of the muscle without dividing the insertion. Fig. 4.

Strictly speaking, although Wheeler applied the term advancement to this method, it may seem to a purist somewhat of a misnomer. Not only is the procedure more of the nature of a "tucking" or "reefing", but the new insertion is further back on the globe than the old. There was no difficulty in carrying out the operation under retrobulbar anaesthesia.

The result was most successful clinically, as by March 12, the man had returned to work using both eyes without prismatic correction. He only had diplopia on extreme movement down to the right, and up to the left. The 13° of cyclophoria had completely disappeared. This is well shown on the diplometer charts 2b and 3b, which also show the slight post-operative weakness of the left superior rectus, and residual overaction of the right inferior rectus and inferior oblique.

The final synoptophore measurements (which have not altered since) were:

- Straight ahead + 3° L/R 2Δ
- 20° to right - 2° L/R 4Δ
- 20° to left + 4° R/L 3Δ

**Reefing of the superior oblique with Hummelsheim's operation**

**Case 2.** The patient (F.A.) a miner, aged 21 years, was buried by a "fall of stone" in September, 1945, which caused a fissured fracture of the left squamo-temporal extending into the base of the skull. This must have caused a paralysis of the left fourth and sixth nerves, as when seen by me for the first time on May 7th, 1946, he had constant diplopia, gross convergence, with limited movements of the left eye outwards, and down to his right. The synoptophore readings were as follows:

- Straight ahead + 22° L/R 6Δ
- 20° to left + 26° L/R 8Δ
- 20° to right + 15° L/R 6Δ

The diplometer record is not reproduced as only slight vertical and torsional errors are shown in it.

**Operation on the left eye, May 23, 1946:**
(a) 6 millimetre recession of internal rectus.
(b) Suture of the outer half of the superior and inferior recti to the insertion of the external rectus.

The original Hummelsheim technique\textsuperscript{11} was employed (it should be noted that variants of this are described as O'Connor's or Temple-Smith's operation).

(c) The superior oblique tendon at a point 6 mm. from its insertion was sutured to the insertion itself, and a further suture inserted to hold the reef firmly.

These procedures were carried out simultaneously under local anaesthesia. Only the outer half of the superior rectus was freed in this case.

The result is still improving, the patient has simultaneous binocular vision everywhere, except to the right, though a slight torticollis compensates a restriction of the internal rectus, when staring fixedly straight ahead.

The synoptophore readings on September 18, 1946:

- Straight ahead $= 0^\circ$ Nil
- $20^\circ$ to left $= 0^\circ$ Nil
- $20^\circ$ to right $= -11^\circ$ R/L 6$^\Delta$

In view of the continuing improvement it was decided not to perform a partial re-advancement of the left internal rectus.

**Recession of the superior oblique**

Case 3. Feb., 1946. The patient J.A.13., a woman aged 68 years, fell on to a key protruding from a chest of drawers. A deep wound was produced in the left lower fornix and the divided inferior rectus sutured. By June, 1946, a gross limitation of the action of the inferior rectus was present with diplopia.

The synoptophore readings were:

- Straight ahead $= -3^\circ$ L/R 16$^\Delta$
- $20^\circ$ to left $= -3^\circ$ L/R 19$^\Delta$
- $20^\circ$ to right $= -3^\circ$ L/R 12$^\Delta$

The patient proved unsuitable for a diplometer test.

June 28: Exploration revealed that the muscle was attached to the globe, but surrounded by massive fibrosis adherent to the orbital rim. A good deal of this fibrous tissue was excised or divided, with slight improvement which was only temporary.

July, 1946. Synoptophore readings:

- Straight ahead $= +3^\circ$ L/R 12$^\Delta$
- $20^\circ$ to left $= +6^\circ$ L/R 16$^\Delta$
- $20^\circ$ to right $= +2^\circ$ L/R 8$^\Delta$
Operation, August 1, 1946. An 8 mm. recession of the right superior oblique was performed under local anaesthesia after temporary division of the superior rectus. This, of course, implies a movement of the oblique insertion forwards and inwards. After the operation it was decided that the inward movement was slightly greater and the forward movement less than the ideal. The result was reasonably good, however, the patient obtaining single binocular vision without prisms everywhere except to the left, where the divergence prevents it. Synoptophore readings on September 7, 1946, were as follows:

Straight ahead = 0° L/R 2°
20° to left = -10° L/R 9°
20° to right = 0° R/L 3°

REFERENCES

INFLAMMATORY JUGULAR PHLEBOSTENOSIS AS THE CAUSE OF GLAUCOMA EXOGENICUM*

by

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NEW YORK CITY

The term "glaucoma exogenicum" is introduced to differentiate this type of glaucoma with extra-ocular cause from "glaucoma endogenicum" that has an intra-ocular cause. Both types of glaucoma are secondary in nature. Just as retinitis albuminurica has its cause outside of the eye, exogenic glaucoma has an extra-ocular cause.

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