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UNDERACTION OF THE MEDIAL RECTUS MUSCLE FOLLOWING SURGERY FOR SQUINT

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Abstract

A series of twenty-three cases of underaction of the medial rectus muscle following surgery for esotropia was investigated.

Of these, four showed marked underaction (24° or less adduction), eight moderate underaction (25° to 29° adduction) and eleven mild underaction (30-34° adduction). Factors associated with medial rectus underaction were:

1. *Large or multiple recession of the medial rectus beyond the oculomotor equator.*
2. *A significant vertical component e.g. V or A sign, superior oblique tendon sheath syndrome.*
3. *Diminished adduction of the fellow eye.*

Prevention of gross medial rectus underaction needs careful design of surgery using A scan and measurement of amplitude of adduction pre operatively especially in the presence of a significant vertical component.

Key words: *Medial rectus underaction, oculomotor equator, vertical deviation, amplitude of adduction.*

When large angle esotropias are operated upon the surgeon often performs "maximal" medial rectus recessions and lateral rectus resections upon the deviated eye in order to correct the large deviation with an operation upon one eye alone. The amount of "maximal" recession performed varies with the surgeon, the muscle often being recessed to "beyond the equator". If very large, the recession may result in underaction of the medial rectus muscle which, if marked, may be cosmetically unacceptable, cause diplopia in the field of action of the muscle, or in some cases be followed by consecutive exo-deviation.

Webb Chamberlain[1] used single muscle medial rectus recessions for esotropia but noted some incomitance post operatively. Hess and Calhoun[2] recommended medial rectus recessions larger than the standard 5 mm. Stockbridge and Moore[3] found incomitance in only a small number of patients having monocular recession/ resection surgery.

It may be reasonable surgical practice to "trade off" a small amount of medial rectus underaction for straight visual axes but a gross underaction is best avoided. We have studied a series of cases with medial rectus underactions of variable degree to see if this can be predicted and prevented paying particular attention to:

(a) The size of the eyeball

(b) The amount of surgery performed

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(c) The nature of the pre-existing deviation, particularly the presence of a vertical component, and amplitude of pre-existing adduction.

PATIENTS AND METHODS

A series of twenty-three patients with underaction of the medial rectus was studied. Following the operation, the angle of deviation was measured, then the ocular movements were examined and any underaction was noted. Various methods of measuring ductions are described. We used a method used by Roper Hall[4] in which the synoptophore was used with a simultaneous macular perception slide in front of the eye to be measured. The patient followed the slide as it was moved away from the straight ahead position until the patient could no longer maintain fixation or a shift in the corneal light reflex was noted. At this point the amount of adduction was measured on the degree scale.

Ductions were considered normal if they measured 35° or more, 30-34° was considered a mild underaction, 25-29° a moderate underaction and 24° or less a marked underaction.

The amount of recession beyond the oculomotor equator was then assessed. Using the method previously described[5] the anteroposterior length of the eyeball from corneal surface to the anterior surface of the retina was measured by A scan ultrasonography and 1 mm added to this to give the anterior-posterior length of the eye. From this the circumference was calculated and then the length of a quadrant from the central cornea to the geometric equator of the eye (¼ of circumference). The oculomotor equator is 2 mm anterior to this on the medial side as the oculo motor axis around which the recti muscles act is approximately 10° divergent to the antero posterior axis. Many of the eyes in this series had been operated upon elsewhere so the precise placement of the recessed muscle on the globe was not known and in these cases a standard corneal diameter of 12 mm with a medial rectus insertion 5 mm from the limbus was applied. This meant that the medial rectus insertion was approximated at 11 mm from central cornea which is rather small for large eyes.

RESULTS

Four patients had marked, eight moderate and eleven mild underation of the medial rectus.

The four patients with marked underaction of the medial rectus had all had large recessions more than 1 mm behond the oculomotor equator, three with two or more operations upon the medial rectus. Three of these patients had a significant vertical component, two having had surgery for this (see Table 1).

Of the eight patients with moderate medial rectus underaction (see Table 2) none had a recession to more than 1 mm beyond the oculomotor equator, although one (A.E.) had multiple operations (3) on the medial rectus and two others (J.B. and Ca.R) had both recession and resection operations for a consecutive eso and consecutive exo respectively. Six patients had a significant vertical component (one with operation). Of the seven patients in whom the

TABLE 1
Marked Underaction of the Medial Rectus

	Circumference & quadrant	Insertion to equator	Recession (mm)	Excess (mm)	Vertical error	Adduction
KL	75/18.75	5.75	8.0*	2.25	No	23 (33)
CS	71/17.75	4.5	6.5*	2.0	Yes (Opn)	24 (35)
TL	68/17	3.75	5	1.25	Yes	22 (35)
NJ	68/17	6.0	10 *	4	Yes (Opn)	22 (45)

* = multiple recessions.
Adduction is given in degrees of rotation. The figure in parentheses gives the adduction in degrees for the fellow eye, and is underlined if this eye had previous surgery.
Opn = previous operation for vertical error.
Excess = excess in mm of recession over distance from the insertion to the oculo motor equator.

TABLE 2
Moderate Underaction of the Medial Rectus

	Circumference /quadrant	Insertion in equator	Recession (mm)	Excess (mm)	Vertical error	Adduction
A.H.	69/17.25	4.25	5	0.75	R10++ R50=	26 (32)
M.S.	75/18.75	6.25	4.5	−2.00	V	28 (38)
C.E.	74/18.5	6.5	6.5	0	No	25 (45)
J.B. (consec eso)	72/18	5	5*	0	Yes (Opn)	26 (31)
Ca.R.†	78/19.5	6.5	?*	?	R10+ LS0+	27 (38)
Cr.R.† (consec. exo)	77/19.25	6.25	4	−2.25	No	27 (38)
G.B.†	72/18	5	5	0	R10+	25 (40)
A.E.†	71/17.75	4.75	?*	?	R10+ RS0−	25 (36)

Conventions as in Table 1.
†=standard value for corneal diameter (11 mm) and medial rectus insertion (5.5) were used because of lack of operative data.

opposite medial rectus was unoperated five had less than 40° rotation on adduction of this normal eye, one patient (J.B.) having only 31°

Of the eleven patients with mild underaction of the medial rectus (see Table 3), one had a recession of 1 mm or more behind the oculomotor equator while another had multiple operations to the medial rectus with one recession "to the equator". All but one patient had a significant vertical component, five having had operation for this. Six patients had less than 40° rotation in adduction of the normal fellow eye.

In the whole series, there was only one patient (C.E. with a moderate underaction) who had a "safe", although large, recession, no vertical component and normal adduction of the fellow eye.

DISCUSSION

Three factors were associated with underaction of the medial rectus muscle in this series:

1. Large recessions of the medial rectus muscle beyond the oculomotor equator or multiple medial rectus recession.
2. Significant vertical component such as inferior oblique over-action, superior oblique tendon sheath syndrome V or A sign.

TABLE 3
Mild Underaction of the Medial Rectus

	Circumference /quadrant	Insertion in equator	Recession (mm)	Excess (mm)	Vertical error	Adduction
J.L.	74/18.5	6	7	1	Yes (Opn)	31 (40)
S.G.†	73/18.25	5.25	5	−0.25	No	31 (38)
K.W. (consec. exo)	71/17.75	5	5.5	0.5	L10+	32 (40)
G.A. (consec. exo)	78/19.5	6.0	5.0	−1.0	A	30 (45)
D.D.† (consec. eso)	77/19.25	5.75	4*	−1.75	Yes (Opn)	32 (36)
R.R.†	71/17.75	4.75	5	0.25	R+L10+	33 (43)
S.H.†	80/20	7	"Equator"*	?	(Yes (Opn)	31 (36)
M.L.†	71/17.75	4.75	5	0.25	L10+	30 (35)
D.C.†	75/18.75	5.75	6	0.25	Yes (Opn)	33 (40)
M.K.†	64/16	5	4	−1	R+L10+	32 (36)
F.G.†	72/18	5	4	−1	Yes (Opn)	33 (38)

Conventions as in previous tables.

3. A diminished amplitude of rotation in adduction of the fellow unoperated eye.

Large recessions of the medial rectus in each case were associated with marked underaction of the medial rectus. This stresses the importance of the oculomotor equator derived by A scan as the limit of "safe" recession. In the other groups with less underaction large recessions were much less frequent and some patients had recessions well in front of the equator.

A significant vertical component was present in most patients with medial rectus underaction whether marked, moderate or mild. Less than half the patients had undergone surgery for this so the degree of vertical component varied. Patients with this vertical component may also have some inherent limitation in adduction which we did not detect pre-operatively.

The presence of poor adduction of the fellow eye suggests that adduction of the operated eye may have also been defective before surgery to the medial rectus. In the group with marked underaction only one case, (K.L.) showed defective adduction of the fellow eye, however in the other two groups this underaction was present in just over half of the fellow eyes. In the past it has not been usual to measure adduction carefully before medial rectus surgery, but this study indicates that it should be measured, especially if large medial rectus recessions are intended.

It is also of interest that six patients showed exotropia at some stage of their clinical course. Two had operations for consecutive esodeviation following operation for exotropia. The others showed exotropia following surgery for esotropia but this needed surgery in only one case. Four of these cases showed poor adduction of the fellow eye and in another it was borderline at 40°.

We have stressed before[5] the importance of measuring ocular dimensions by A scan to determine the oculo motor equator which is the limit of safe medial rectus recession. It may be reasonable to "trade off" some limitation of adduction postoperatively for straight visual axes. However, care is needed particularly in the presence of a significant vertical component or limitation of adduction. This limitation of adduction may not be obvious on observation of ocular movement, but careful testing of the range of adduction with the synoptophore may show that only limited adduction is present.

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