Bilateral failure of adduction following orbital decompression

F Kinsella, P Kyle, A Stansfield

Abstract
We report a case of bilateral complete failure of adduction following bilateral translid antral-ethmoidal orbital decompression. We believe the probable mechanism is neuropraxia (temporary dysfunction) of the third cranial nerves' supply to the medial recti, owing to these nerves' occupying an anatomically abnormal position. Partial recovery of adduction occurred over the ensuing six months.

In 1975 a 34-year-old woman in whom thyrotoxicosis and pretibial myxoedema had very recently been diagnosed was referred by the endocrinological service to our department for ophthalmological assessment. Examination at that time showed her best vision was 6/9 in both eyes (with a -2.0 sphere and +5.50×80° in both eyes). Bilateral exophthalmos was present, the Hertel exophthalmometer measuring 23 mm on the right and 21 mm on the left side. Moderate lid lag and retraction were noted. A mild degree of lagophthalmos was present bilaterally, but corneal examination showed a normal appearance. Pupillary and fundal assessment gave normal results, as did measurement of intraocular tensions. The patient showed absence of convergence, but otherwise ocular movements were full.

Over the succeeding 11 years our patient's ocular status remained remarkably stable, her only symptoms being occasional grittiness. In 1987, however, her disease became much more active, with the appearance of marked congestion over the insertions of the horizontal recti and oedema of the caruncles. Corrected visual acuity fell to 6/18 bilaterally, and slight swelling of both optic discs became apparent. The degree of exophthalmos, however, remained static, and at no stage was there evidence of exposure keratitis. A CT scan of the orbits showed signs consistent with compressive neuropathy, and, because of her failing to respond to high-dosage systemic steroids, bilateral translid antral-ethmoidal decompressions were performed in August 1987.

The surgical procedure was uncomplicated, but it was noted at the time of surgery that the anterior ethmoidal arteries were located far more antero-inferiorly than normal.

On the day after surgery the patient's vision had improved to 6/12 in the right and to 6/9 in the left eye, but a marked divergent squint in the primary position was present (Fig 1). Examination of ocular movements revealed bilateral failure of adduction, the right eye being unable to reach the midline (Fig 2A) but reaching the midline on the left side (Fig 2B). The patient's other eye movements were normal. Forced duction testing demonstrated limitation of adduction in the right eye only on extreme adduction, whereas the left eye showed no limitation of adduction whatsoever. Force generation testing (whereby the patient performs ocular movements on command while the surgeon grasps the insertion of the appropriate...
rectus muscle) showed that active adduction from the abducted position was entirely absent in the left eye, and though present in the right eye, its force was markedly diminished. A repeat orbital CT scan, apart from demonstrating signs of the bilateral floor and medial wall decompressions, showed that the recti muscles were essentially unchanged in appearance: in particular there was no evidence of avulsion or disinsertion of the medial recti (Figs 3A, 3B).

A trial of high-dosage systemic steroids failed to produce any improvement in ocular motility and was consequently discontinued after one week. Over the succeeding months, however, the patient’s adduction began to improve spontaneously, so that six months after surgery some recovery of adduction had occurred bilaterally (Figs 4A, B). In addition the patient’s convergence – which had not been present since first assessed in 1975 – had shown a certain amount of recovery (Fig 5).

At present (two years after surgery) our patient’s ocular motility has shown considerable improvement. There has been significant recovery of adduction bilaterally, some convergence is present, and there is only 5° of left divergence in the primary position (Fig 6).

**Discussion**

Muscle imbalance following orbital decompression is well recognised, but apart from the Naffziger anterior cranial fossa approach, which may be complicated by damage to the superior orbital fissure structures (resulting in third, fourth, or sixth cranial nerve pareses), the mechanism is almost invariably a mechanical disturbance of the extraocular muscles. The risk of muscle imbalance depends on the particular procedure performed, being a frequent complication of three wall (36% in the series of Harting et al.) and transantral anterio-ethmoidal (33-41%), but rarely following translid anterio-ethmoidal decompression (5-6%). The much higher incidence of motility disturbance following transantral rather than translid anterio-ethmoidal decompressions is thought by some to be related to a more posterior decompression being achieved with the former approach, causing loss of support for the muscle cone at the orbital apex, though lack of direct visualisation with the former approach may contribute somewhat to this higher incidence. The occurrence of an A-pattern of motility disturbance in eight out of a series of 14 patients following anterior ethmoidal orbital decompression has recently been reported, the postulated cause being selective disruption of orbital fascial septa by the relieving peristomal incisions.

We believe that our patient’s bilateral failure of adduction was due to neuropaxia (temporary dysfunction) of the third cranial nerves’ supply to the medial recti for the following reasons: force generation testing demonstrated an inability to adduct the eyes on command, forcedduction testing failed to show any significant mechanical restriction, while inadvertent avulsion of the medial recti was excluded by CT scanning. Additional evidence of neuropaxia is that some recovery of adduction occurred over a six-month period. So far as we are aware this is the first documented case of bilateral isolated adduction failure following orbital decompression.

As the medial recti are normally innervated from the global aspect, trauma to these nerves...
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Figure 5: Some recovery of convergence six months postoperatively.

Figure 6: Recent photograph showing the eyes in the primary position. The corneal reflexes are asymmetrical, and the cover test reveals that 5° of left divergence is present.

Figure 7: Diagram of the medial rectus branch of the inferior division of the third cranial nerve entering the orbit through the superior orbital fissure. The usual route into the orbit through the annulus of Zinn, as well as the aberrant route outside the annulus of Zinn postulated in our patient, are illustrated.

during an uncomplicated translid antrol-ethmoidal decompression can be explained only by postulating an aberrant anatomical route for these nerves. The medial rectus muscle is usually innervated from the global aspect because its supplying nerve enters the orbit through that part of the superior orbital fissure surrounding the annulus of Zinn. We postulate that in our patient the nerves to the medial recti entered the superior orbital fissures outside the annulus of Zinn (as does the trochlear nerve), thus gaining access to the orbital aspect of the medial recti muscles (Fig 7), where it was injured during surgery. This theory is supported by the symmetry of the lesions produced on both sides and the peroperative observation that the anterior ethmoidal arteries occupied an abnormal position in the orbits.

A surprising outcome was partial recovery postoperatively of the patient’s convergence (which had been absent for many years). This was presumably related to the increased mechanical advantage afforded the medial recti after retrodisplacement of the globes.

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1 Trokel ST, Cooper WC. Orbital decompression effect on motility and globe position. Ophthalmology 1979; 86: 2064–70.
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**Notes**