How to avoid problems when managing patients with sensory strabismus.

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Sensory strabismus is a common problem and occurs when impaired vision in one or both eyes causes a loss of binocular function. It is important to identify those patients where vision in an affected eye can be restored, but in particular to predict whether fusion can be restored, as recovery of vision without fusion can lead to intractable diplopia.¹

Loss of fusion may be secondary to poor visual acuity or visual field in one or both eyes or may occur when there is incompatibility between the images from the two eyes.

Children with sensory strabismus tend to converge whereas adults more commonly diverge.²

Loss of fusion may be caused by problems at any point along the visual pathways. Common causes of loss of fusion are:

- Keratoconus³
- Corneal opacity
- Dense unilateral cataract⁴,⁵,⁶
- Retinal displacement following retinal detachment repair
- Retinal dystrophies or disease
- Optic nerve anomalies or injury
- Loss of visual field from glaucoma or neurological disease
- Amblyopia

Questions determining management strategy

1. Is there any prospect of restoring vision?
2. What is the prospect of restoring binocular function?
3. Is there a risk of double vision after surgery if there is no fusion?

1. Is there any prospect of restoring vision?

History - Is the condition inherently reversible?
  - What is the risk of unseen posterior segment damage behind an opacity?

Examination

- Evidence of past trauma, cornea, sclera, pupil, lens, fundus, afferent defect
- Accurate projection of light?
- Associated motility problems

Investigations

- Ultrasound
- Electrophysiology
2. Will the patient regain fusion if vision is restored?

Immediate factors

Is there visual incompatibility?
- Asymmetric astigmatism
- Anisekonia, commonly from anisometropia.
- Emmetropia in a patient previously adapted to anisometropia
- Distortion from a macular hole\textsuperscript{7} or epiretinal membrane\textsuperscript{8}

Refractive adjustments to assist fusion

- For asymmetric astigmatism omit cylindrical correction and use spherical equivalent in poorer eye to minimize differential image distortion.
- For anisekonia use spectacle lens to correct image size difference and cancel refractive effect with a contact lens.

Are there long-term changes in the central visual pathways leading to loss of fusion?

Effects of visual deprivation in adults.

Risk factors

- Visual acuity
- Duration of visual loss
- Duration of divergence
- Nature of visual loss
- Age of patient

Longstanding asymmetric keratoconus\textsuperscript{3}

20 patients with severe unilateral keratoconus corrected with a scleral contact lens
With contact lens 14 phoric, 6 microexotropia
Without contact lens 19 were exotropic with suppression and one had diplopia
All except one had poor or absent stereopsis

Longstanding dense unilateral adult-onset cataract\textsuperscript{6}

Eleven patients with longstanding dense unilateral, adult onset cataract either present for at least a year or else divergent
All 6/9 or better on day 1 after cataract surgery
Nine fused, one had diplopia which recovered spontaneously and one remained divergent with diplopia
Mean VEP delay from affected eye of 9.8 msec which resolved over about 3 months
No delay for 8 control patients with early cataracts
Two patients with diplopia had initial delays of 29 and 16 msec
3. If the patient is unable to fuse, will they suppress or ignore any second image?

Post-op diplopia test
If positive, temporary realignment with Botulinum toxin
Prism wear

Patients with divergence from poor vision from bilateral advanced retinal dystrophies appreciate squint surgery, even though they cannot themselves see their squint. However, even with very poor vision they can experience troublesome double vision and need to be fully assessed before surgery, preferable by being temporarily aligned using Botulinum toxin\(^9\).

Intractable Diplopia

Loss of fusion due to changes in central visual pathways\(^4,5,6\)

Nine patients following removal of a longstanding unilateral cataract or prolonged aphakia\(^10,11\).
At least 6/9 each eye
Reduced contrast sensitivity in affected eye
Delayed and reduced pattern reversal VEPs
Reduced binocular beat VEPs

Assessment

Orthoptic examination, especially synoptophore if vision allows
Postoperative diplopia testing with prisms
Heimann-Bielschowsky phenomenon predicts lack of fusion potential and so risk of intractable diplopia\(^12,13\).

Refractive correction and realignment with Botulinum toxin\(^14\)

383 patients with secondary exotropia

Trauma 36%
Congenital anomalies
Refractive error
Retinal detachment
Senile cataract
Cornea
Glaucoma

43% proceeded to surgery
8% required no further treatment

Management options for patients with intractable diplopia

Occlusion e.g. Bangatter foil or occlusive contact lens
Occlusive intraocular lens\(^15,16\).
The fundus can now be monitored through an opaque lens with ultrasound or SLO/OCT\(^17\).
Practical aspects of surgery

Non-fusing eyes tend to rediverged following surgery.

85% ‘straight’ after 5 years\(^{18}\)
75% ‘straight’ after 10 years

So in a young patient plan for the long term and anticipate the need for further surgery for redvergence.

A generous medial rectus resection and lateral rectus recession using adjustable sutures allows later surgery to fellow eye for redvergence.

If there is a history or evidence of previous trauma, dissect gently without pressure on the sclera.

If the lateral rectus of the affected eye has already been recessed or previous trauma is a major concern, then surgery to the fixing eye may be the best option if it is acceptable to the patient.

Long-term management with repeated Botulinum toxin may be the best option if further surgery is unacceptable to the patient, if there is a risk of phthysis or if the patient is infirm.

Surgery with adjustable sutures

Binocular patient - adjust to fuse comfortably.

Non-binocular patient - Leave as far esotropic as the patient (and family) will accept

Adjustable sutures allow adjustment for

- Accuracy of alignment for fusion, especially if fusion is weak
- More generous correction for non-binocular patients as any overcorrection can be adjusted back
- Minimise diplopia risk - may allow a suppression scotoma to be found.

Illustrative case histories will be discussed with audience participation.

**Summary:** The selection of patients for surgery to restore vision and/or ocular alignment will be presented. The causes and underlying mechanisms of the development of sensory strabismus in children and adults will be described. The clinical and orthoptic assessment of such patients will be discussed, together with the use of Botulinum toxin for both assessment and treatment.
References:

9. Dawson E, Leung H, Webster AR, Lee JP. I can't see my squint . . . but I know it's there! J AAPOS 2010, 14; e14-15
18. Moorfields audit data.