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# Heroin and diplopia

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## ABSTRACT

**Aims** To describe the eye misalignments that occur during heroin use and heroin detoxification and to give an overview of the management of persisting diplopia (double vision) which results from eye misalignment.

**Methods** A literature review using Medline and the search terms strabismus, heroin and substance withdrawal syndrome is presented. General management of cases presenting to the ophthalmologist and orthoptist with acute acquired concomitant esotropia is described.

**Findings** A tendency towards a divergence of the visual axes appears to be present in heroin users, although when present it may not always lead to diplopia. Following detoxification intermittent esotropia or constant esotropia (convergence of the visual axes) can occur; if intermittent the angle tends to be small and diplopia present when viewing distance objects. Occlusion of one eye to eliminate the second image could encourage the development of a constant deviation. The deviation is not caused by a cranial nerve palsy. Constant deviations of this type are classified as 'acute acquired concomitant esotropia'. Relief from the diplopia may be gained by prismatic correction, and the deviation may then resolve spontaneously. Botulinum toxin or surgical intervention may be necessary in cases that do not resolve.

**Conclusions** Heroin use may lead to intermittent or constant exotropia and withdrawal may result in intermittent or constant esotropia. Awareness of the mechanism causing this may avoid referral to other specialties (e.g. neurology) and awareness of treatment modalities could encourage patients to seek appropriate help for relief of symptoms.

**KEYWORDS** Esotropia, heroin, methadone, strabismus, substance withdrawal syndrome.

## INTRODUCTION

Binocular double vision (diplopia) occurs when there is a misalignment of the visual axes of the two eyes (strabismus). An inward-turning eye leads to esotropia or convergent deviation and an outward-turning eye to an exotropia or divergent deviation. Ocular deviations can also result from a palsy of one or more of the nerves supplying the extraocular muscles, or a defect of an extraocular muscle. In such cases, however, the deviation is incomitant; that is, it varies with direction of gaze as opposed to concomitant deviations where the angle is

similar in different directions of gaze. Table 1 gives a glossary of terms for easy reference.

Recently double vision, in the absence of a nerve palsy, has been reported in the orthoptic and ophthalmological literature either on the use of, or following detoxification from, heroin. This article presents a review of the published literature regarding the nature of changes in ocular alignment following detoxification, and the small amount of evidence that eye alignment may be affected by the use of heroin (search terms: strabismus, heroin and substance withdrawal syndrome). Secondly, the type of strabismus which appears to occur on withdrawal from

**Table 1** Glossary of terms.

Concomitant	Angle of deviation between the eyes is similar in different directions of gaze
Convergent deviation	An inward-turning eye. Used interchangeably with esotropia
Diplopia	Double vision
Divergent deviation	An outward-turning eye. Used interchangeably with exotropia
Esotropia	An inward-turning eye. Used interchangeably with convergent deviation
Exotropia	An outward-turning eye. Used interchangeably with divergent deviation
Incomitant	Angle of deviation between the eyes varies with direction of gaze
Strabismus	Misalignment between the eyes
Hypermetropia	Long sight
Myopia	Short sight
Refractive error	Hypermetropia or myopia
Accommodation	Focusing of a near image by change in the intraocular lens
Stereopsis	3D vision from the use of both eyes
Internuclear ophthalmoplegia	Loss/reduction of adduction of affected side with nystagmus of contralateral eye on adduction

heroin is discussed, and finally methods for the treatment of double vision that may be undertaken by the orthoptist or ophthalmologist are considered.

## HEROIN USE AND DIPLOPIA

Reported cases of problems in ocular alignment on the use of heroin are rare. Only two cases of constant exotropia on methadone and/or heroin use have been reported [1]. In the first heroin was used after the patient had remained clean for 1 year; double vision occurred hours after intake. Exotropia was present and resolved within 4 days. The second used heroin and methadone and the development of exotropia was dependent on the intake; this patient had undergone strabismus surgery at the age of 2 years.

Patients prior to detoxification for heroin/methadone were compared with a control group of non-drug users and found to have larger misalignments at near in the divergent direction [2]. Although this tendency for divergence could be controlled by many, a tendency for the misalignment to become apparent was present; double vision, however, was seldom present, the second image being ignored.

Cases of internuclear ophthalmoplegia (INO) following opiate overdose have been reported [3,4]. Internuclear ophthalmoplegia is seen commonly in demyelination of, or haemorrhage within, the medial longitudinal fasciculus. Clinically it presents as loss or reduction of adduction (movement of the eye towards the nose) on the affected side with nystagmus of the contralateral abducting eye. The ability to converge the eyes to keep looking at an approaching target may or may not be affected. Rizzo & Corbett [5] report one case of bilateral INO in a known polydrug user (currently using methadone, diazepam, propoxyphene and phenytoin sodium

irregularly for generalized seizures coincident with the multiple drug use). On presentation there was a decreased level of responsiveness; he was complaining about headaches, blurred vision and lethargy. Naloxone was administered and within 5 minutes the patient was alert and eye movements returned to normal. This response to naloxone is suggestive that the opiate was responsible for the eye movement defect, although no opiate receptor sites have yet been identified in the region of the medial longitudinal fasciculus. The bilateral INO returned about 3 hours later but resolved completely by day 4.

## DIPLOPIA FOLLOWING HEROIN DETOXIFICATION

When describing the signs and symptoms of abrupt withdrawal from heroin Himmelsbach [6] stated: 'Occasionally a patient will complain of double vision. Nearly all patients, if they try to read, complain of some impairment of vision.' The incidence of 'diplopia and/or blurred vision' during withdrawal among soldiers returning from Vietnam was reported as between 10% and 33.3%, depending on the mode of heroin use [7]; however, no distinction was made between blurring of vision and diplopia and no reason for either was given. Since then, little attention has been given to problems relating to strabismus (Table 2). A single case of diplopia during heroin withdrawal appeared to be related to chlorpromazine; the diplopia resolved 6–8 hours after use and recurred if chlorpromazine was taken. However, the type of strabismus is not given but it is stated that the diplopia was not due to extra-ocular muscle paresis [8].

Three case series of diplopia following withdrawal from heroin have been published recently [1,9,10]. Each of these patients (totalling 13) demonstrated an esotropia

Author (year of publication)	Research design	No. of participants
Ream <i>et al.</i> (1975) [7]	Observational	496
Iqbal (2000) [8]	Case report	1
Firth (2001) [9]	Case series	3
Kowal <i>et al.</i> (2003) [10]	Case series	5
Sutter & Landau (2003) [1]	Case series	5
Firth <i>et al.</i> (2004) [2]	Prospective, repeated-measures design	69

**Table 2** Literature pertaining to diplopia on withdrawal from heroin.

whether looking at near (33 cm) or in the distance (6 m), commonly of moderate size (25Δ–30Δ), although sometimes smaller. All patients complained of diplopia. In one series [10] of five patients, two had a history of hypermetropia (long-sightedness). Overall six of the cases resolved (two with the help of prisms on glasses in the interim), one resolved on re-use of heroin, one was listed for surgery and in five follow-up was not reported or the patients were lost to follow-up.

Kowal *et al.* [10] surveyed 51 doctors on the methadone prescriber list in the state of Victoria, Australia, 22 of whom treated over 100 patients per year and 29 of whom treated 25–100 patients per year. Five of those surveyed prescribed naltrexone. Of these five one reported 'about 20 cases' of strabismus during detox; one 'about 10 cases'; blurred vision but no strabismus was reported by the other. Of the remaining 46 doctors, only two reported seeing strabismus, and these were few—four cases by the first and only one case by the second. This led to the conclusion that diplopia may be more prevalent in rapid naltrexone detoxification.

In a prospective study [2], set in a detoxification centre using a 5-day naltrexone compressed opiate detoxification regimen [11], several parameters were assessed on admission and prior to discharge to determine changes in the alignment of the visual axes and control of any potential ocular misalignments. A statistically significant change was found in the angle of deviation when fixing at 6 m but not at 33 cm. This was also of clinical significance, and led to an intermittent or constant esotropia with diplopia in 21 of 66 patients. The deviation was not related to long-sightedness. Measurements of the misalignments on side gaze, and measurement of the ability of the eyes to maintain single vision when forced divergence was demanded by use of prisms, showed that this change in angle was not due to 6th cranial nerve palsy(ies) or divergence insufficiency (inability of the eyes to make a divergence movement). These are conditions that would usually be considered where the eyes turn in more for distance than near. This led the authors to suggest that opioid receptors in the brain stem in areas responsible for maintaining eye alignment may be responsible. Follow-up was not undertaken but a telephone survey of eight cases with diplopia at distance

showed that resolution of diplopia occurred between 2 days and 3 weeks; none sought referral within this period (unpublished data). It is probable that many cases with an intermittent problem of this nature do resolve, although evidence is not currently available to support this assumption.

### THE MECHANISM FOR DEVELOPMENT OF CONSTANT ESOTROPIA

The intermittent nature of the esotropia reported at distance (6 m) after heroin withdrawal is similar to that which may occur in patients with myopia (short-sightedness) [12]. The deviation may increase progressively in size. A period of temporary fusional disruption, i.e. loss of the eyes being used together because of the strabismus, may precipitate esotropia or lead to decompensation of a pre-existing tendency for misalignment [13,14]. Decompensation is where the control of the eyes working together is lost; this may happen intermittently or lead to a constant deviation. Decompensation may also be precipitated by the use of occlusion to get rid of diplopia [14–16]. Thus patients suffering diplopia at distance could, by either of these mechanisms, develop constant esotropia. This type of strabismus is termed 'acute acquired concomitant esotropia'.

Acute acquired concomitant esotropia is an uncommon form of esotropia, although the following case series of this type of strabismus do appear in the literature, unrelated to heroin use. Ten cases presented to one department over a 3.5-year period [17]. Their ages ranged from 3.5 years to 10 years, with the exception of one case, who was 24 years old. Most case series reported are in the childhood age bracket [18–21]. However, a few cases are to be found in the adult age group (two cases [22] and one case [23]). One series of 10 cases over the age of 16 years is reported, presenting over a 7-year period [24]. Long-sightedness was present in some patients and its correction was sufficient to control the deviation [15,23]. Conversely, short-sightedness may be present [24]. The onset of this type of strabismus can be related to neurological disease [25], but further investigation is not usually undertaken unless there are

accompanying neurological signs. Thus acute acquired concomitant esotropia is even less common in the adult population than during childhood.

## MANAGEMENT OF ACUTE ACQUIRED CONCOMITANT ESOTROPIA

Where acquired esotropia presents the first stage of management is to correct any refractive error present. Correction of long-sight may help the deviation as it removes excessive effort of focusing and thus reduces the associated convergence. Patients who present with a late-onset form of esotropia have developed the ability to use their eyes together and have stereopsis prior to the onset of the strabismus, hence the aim of treatment is to restore the correct eye alignment. Prismatic correction by the use of Fresnel prisms (plastic film composed of prisms) placed onto spectacles enables the two images to be joined and restores the use of the two eyes correctly. This may be as a temporary measure prior to surgical correction [21], but can lead to resolution of the deviation. This occurs as the patient regains the use of the two eyes correctly and the prism strength can then be gradually reduced [16]. Two cases of esotropia reported following heroin detoxification were controlled in this way [9,10].

While many cases with acquired esotropia require strabismus surgery [17,21,24], an alternative is an injection of botulinum toxin into the medial rectus [21,22,26]. This temporarily paralyses the medial rectus, causing a reduction in the esotropia or even divergence of the eyes. Once fusion is restored it is usually maintained as the effect of the botulinum toxin gradually wears off.

## CONCLUSIONS

Esotropia may occur after detoxification from heroin. The diplopia that this causes is a disturbing symptom, but is treatable by prismatic correction in the short term, botulinum injection and strabismus surgery in the longer term if the esotropia persists. Occlusion of one eye should be avoided as this may encourage decompensation to a constant deviation. Where the esotropia is constant or persists as an intermittent problem, patients should be referred for an orthoptic opinion. Changes in ocular alignment can also occur on use of heroin and very occasionally this may lead to diplopia.

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