Original article

Horizontal sensory strabismus: Characteristics and treatment results

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A B S T R A C T

Purpose: To study the types of horizontal sensory strabismus, their causes, and treatment outcomes.

Methods: A retrospective analysis of 44 patients with horizontal sensory strabismus who were treated from 2002 to 2007. Patients whose worse eye vision was inferior or equal to 0.2 were included. The deviation angle in primary position, causes, type of treatment, and pre-operative or post-operative diplopia were studied. A good result was considered if the final deviation was less than 10 prism dipters (pd).

Results: Of the patients studied, 63.6% had exotropia and the 36.4% had esotropia. The visual acuity was between 0.1 and no light perception in 75% of patients. The causes responsible for low vision were congenital in 28, and acquired in 16 cases. The mean deviation was 46.7 pd. Diplopia was present in 5 cases, which were resolved with surgical treatment in 3 of them. The eye with reduced vision was operated on in 37 patients, both eyes in 6 cases, and botulinum toxin was injected in 1 case. The final outcome was successful in 90.6% of the cases which were surgically treated. The mean follow-up was 31.84 months.

Conclusions: There were twice as many exotropias as esotropias. Strabismus surgery of the amblyopic eye shows excellent results without the need of new operations. There were no new diplopia cases.

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R E S U M E N

Propósito: Estudiar los tipos de estrabismo sensorial horizontal, sus causas y los resultados obtenidos con el tratamiento.

Método: Estudio retrospectivo de 44 casos diagnosticados y tratados de estrabismo sensorial horizontal entre 2002 y 2007. Se incluyeron los pacientes con una AV ≤ de 0,2 en el ojo con peor visión. Se estudiaron la desviación en PM, las causas, el tipo de tratamiento realizado, y la presencia de diplopia pre y postoperatoria. Se consideró buen resultado si la desviación final era ≤ 10 dioptrías prismáticas (dp).

Palabras clave:
Endotropía sensorial
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Cirugía
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Introduction

Sensory strabismus is caused by temporary or permanent loss of vision in one or both eyes. Its prevalence is of 5–9%. It is considered that when the visual loss occurs in childhood there is a tendency towards endotrophy (ET) and when it occurs in adults the tendency is to exotrophy (XT). The etiology is varied.

The typical objectives of strabismus surgery are to achieve ocular parallelism in order to reestablish binocularity and stereopsis, eliminate diplopia, improve or remove torticollis, and alleviate symptoms such as astenopia and increase the binocular field of vision in esotrophy. In sensory strabismus these objectives may not be achieved. However, considering the negative psychosocial impact in patients, sensory strabismus surgery should be considered as a reconstructive surgery and not only aesthetic, without underestimating the functional improvements that can be obtained.

Although severe amblyopia is considered to be a poor prognosis factor to obtain good motor and sensory results in the short and long-term, there are very few published studies on the results of sensory strabismus surgery. The purpose of this paper is to study the types of horizontal sensory strabismus and the results obtained in its surgery.

Subjects, material and methods

A retrospective study of 44 cases was carried out among patients who visited the ocular motility practice requesting treatment for ocular deviation on aesthetic grounds. They were diagnosed and intervened with surgery or botulin toxin for sensory horizontal strabismus from January 2002 to December 2007. The study excluded patients with follow-up periods under 6 months from the treatment. The study and surgical procedures were carried out in accordance to the principles established in the Helsinki declaration.

Sensory strabismus has been defined as a deviation secondary to diminished vision in one or both eyes. It included all patients with VA < of 0.2 in the eye with the poorest vision. The VA was determined with the Snellen test.

The following pre-surgery data were analyzed: age, sex, main and secondary associated strabismus type, probable etiology of the VA reduction, age of the visual loss, age of strabismus onset, previous strabismus surgery, diplopia, amount of deviation in prismatic diopters (pd) and existence of wryneck. The ocular deviation was measured with the Krimsky test if the ocular fixation was poor or with the cover–uncover test utilizing prisms if the VA allowed it.

The age of visual loss and the age of strabismus onset were classified as childhood age if it occurred before age 8, and adult if it occurred after 8 years of age.

The type of surgery to correct strabismus was also studied, together with the presence of post surgery diplopia and evolution time.

A good motor result was considered when the deviation in the last exploration was of ≤10 pd even with diplopia, provided it was also present prior to the surgery and did not appear after it.

A statistical study of the relationship between age and type of horizontal deviation was carried out (XT or ET) with SPSS 15.0 software, considering a value of p > 0.05 by means of the T for Student’s test as non-significant.

Results

Of the 44 patients diagnosed and intervened for sensory horizontal strabismus, 22 were males and 22 females. The mean age of the sample was of 33.4 years, SD: 14.7 (range, 5–71 years). In 28 cases XT was diagnosed (63.6%) and ET in 16 cases (36.4%). Although the mean age of patients with XT was of 35.9 years, older than the mean age of cases with ET: 29.1, there were no statistically significant differences between both groups.

Associated deviations were not observed in 16 patients whereas in the rest one slight V-syndrome was diagnosed, one A-syndrome and/or one vertical deviation (DV) in primary gaze position (<10 dp). One case had nystagmus (Table 1). Torticollis was not observed in any patient.

Table 1 summarizes VA data for both eyes, likely cause of visual loss, onset age of the visual loss and strabismus, horizontal deviation, previous strabismus surgery and presence of diplopia.

The VA of the worse eye varied between 0.2 and NPL. Overall, 4 patients did not have light perception (NPL) in one eye. Seventy-five percent had VA between 0.1 and NPL.

The probable causes of vision loss were congenital in 28 cases and acquired in 16. Most frequent causes were refractive errors in 12 cases, congenital strabismus in 7, congenital cataracts in 5 and perforating traumatism in 5, while 4 cases...
exhibited optic nerve damages. Vision loss occurred during childhood in 33 patients (75%) and in adulthood in 11 (25%). The deviation onset occurred during childhood in 28 cases (63.6%) and in adulthood in 16 (36.4%).

Out of the 44 cases, 3 had been previously intervened for strabismus in other hospitals. The mean deviation was of 46.7 dp, SD: 19.8 (range, 18–90). Diplopia was referred by 5 patients at diagnostic time.

**Table 2** summarizes data on performed surgeries, number of surgical procedures, anesthesia, post surgery diplopia, results and evolution time. Surgery was performed only on the amblyope eye in 37 patients. In 6 it was bilateral and in one botulin toxin was injected in the ambylope eye due to surgery rejection without achieving good results. In 32 cases two muscles were operated, in 4 cases only one, in a further five cases 4 muscles were operated and in two cases three muscles. Of all operated patients, 38 required one intervention and 5 required two (three under general anesthesia and two with topical anesthesia). In 21 patients general anesthesia was applied (GA) and topical anesthesia in 22 (TA).

The result obtained with surgery was good in all cases (90.6%) except in 4, with two maintaining pre-existing post surgery diplopia. In 3 of the 4 cases with poor results, GA was applied and TA in one. The mean evolution time from surgery
or botulin toxin injection was of 31.84 months, SD: 20.2 (range, 6–71 months).

**Discussion**

The main objective of strabismus surgery is to achieve parallelism of eyes in order to establish or improve binocularity. It was always believed that moderate or severe amblyopia was a poor prognosis factor for achieving stability in short and long-term results both in children as in adults. For this reason, many patients with sensory strabismus even nowadays have the false impression that their deviation cannot be corrected. It is erroneously considered that adult strabismus surgery is aesthetic surgery even when the patient has good VA due to the false belief that BV and stereopsis cannot be recovered once the patient has reached visual maturity at age 8–9. Recent studies found in the literature argue that strabismus surgery is reconstructive surgery as it aims at correcting a pathology. It also eliminates diplopia and torticollis in 71% and 80% of cases, respectively. Half of patients with strabismus from childhood can recover BV in the adult age, and even those who do not exhibit fusion and stereopsis with diagnostics tests can have good motor results in the long-term.

Not many papers in the literature have studied the surgical results of sensory strabismus. Some authors have reported that the botulin toxin is a good option to surgery for this type of strabismus as it is a noninvasive technique.
However, Dawson et al. only obtained 8% of good results with a single injection of botulin toxin whereas 20% of their cases required maintenance treatment with repeated botulin toxin injections, and 43% required surgery after said treatment.\(^2\)

The series by Oliveira et al. reported good results with surgery in sensory strabismus, with 90.5% of patients achieving deviations under 15 dp.\(^1\) In our series, 90.6% obtained good motor results with a final deviation under 10 dp. For Oliveira et al., the frequency of esotropia and exotropia was virtually the same,\(^1\) while Dawson et al. found 76% of exotropia against 22.5% of esotropia and 1.5% of vertical deviations.\(^2\) In turn, Scott published double the amount of exotropia than esotropia.\(^8\) In our series, 63.6% had XT and 36.3% ET, in 63.6% another type of slight associated deviation was found (syndrome A, V or Dv). Although the mean age of the ET cases was smaller than that of XT cases, the difference was not significant. However, other authors obtained significant differences between the mean age of both groups.\(^3\)

Botulin toxin was injected only in one patient of the sample because he had undergone strabismus surgery in another hospital and rejected a second operation. Although initially ocular alignment was achieved, at the end of the follow-up the result was poor.

Although it is not the aim of this paper to analyze the negative psychosocial impact of strabismus in patients, this has been published in other studies.\(^4,12-15\) All our cases asked for surgery and accepted the possibility of poor prognosis for the long-term stability of the surgical correction.

In most cases of the series (86.04%) surgery was performed only in the amblyope eye, a percentage similar to that of Oliveira et al.\(^1\) with a percentage of 97.5%. His two bilateral operations were XT with 60–80 dp. In our six cases operated on both eyes, amblyopia was deep: three with FC, two with HM, and one with 0.1. The deviation was of 70–80 dp, excepting two patients with 40 dp. Out of the six, four were ET and 2 were XT.

Although diplopia is a risk and a secondary complication of adult strabismus surgery, even in the presence of deep amblyopia, with a prevalence of 1–7%,\(^6,8\) none of our patients referred it after surgery and it even disappeared in three out of the five patients who exhibited it before surgery.

The percentage of re-interventions was low, only of 11.6%, which is below the 20% of patients that required repeated injections of botulin toxin as maintenance treatment.\(^2\)

In this study, we can conclude that sensory XTs accounted for almost twice the amount of ETs. Surgery has achieved very good motor results in virtually all the cases at the end of the follow-up period. For the majority of patients, it was necessary to operate only the amblyope eye. A small percentage required re-intervention and over half of patients were operated with topical anesthesia, thus facilitating intra-surgery adjustments.

### Conflict of interests

The authors have no conflict of interests to declare.

### References