Intermittent Exotropia: Management Options and Surgical Outcomes

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Abstract

Background: *This paper reflects an effort to recreate a modern analysis of a 1985 study on surgical outcomes of intermittent exotropia. Post-surgical results are reported as functional, motor, cosmetic, and unsuccessful. Modern optometric approaches to management of intermittent exotropia are also discussed.*

Methods: *A literature review of 17 acceptable papers (dating from 1990-2011) on the outcome of strabismus surgery for intermittent exotropia was conducted. Search words included: intermittent exotropia, strabismus, strabismus surgery, and strabismus surgical outcomes.*

Results: *No papers exactly fit the rigorous standards of the original 1985 study regarding surgical outcomes for intermittent exotropia. Some modern papers did not differentiate between exo deviations (exophoria versus exotropia) or strabismic deviations (esotropia versus exotropia). Not one study reported an absence of post-surgical strabismus and concomitant functional improvement. However, in papers citing functional results only, 62.3% of patients had successful post- surgical outcomes.*

Conclusions: *Data from the 1985 study on surgical outcomes of intermittent exotropia is impossible to recreate in 2011. Interestingly, more surgeons/authors in modern studies show an interest in post-surgical functional vision than in the 1985 version. Very few modern studies analyze the use of vision therapy concomitantly with strabismus surgery. This is a potential area of future interest.*

Key Words

exotropia, intermittent exotropia, strabismus surgical outcomes, strabismus surgery, vision therapy.

Introduction

It is estimated that strabismus affects 2% to 6% of the general population.[1] One study suggests that 20.4% of strabismics are exotropes.[1] However, this number is likely an underestimate because of the typical intermittency seen in exotropia. Among the most common treatment methods are minus lenses, prism, occlusion, vision therapy, and surgical intervention. A 1991 study by Coffey et al. [2] compared these five treatment options (Figure 1).The highest success rate (61%) was seen in patients post-strabismus surgery, when only analyzing cosmetic results. When post-surgical functional results were also considered, the success rate dropped to 43%. Optometric Vision Therapy (OVT) had the highest rate of functional success (59%). Occlusion therapy, with a wide range of applications, was successful in managing 37% of cases. Both prism therapy and minus lens therapy demonstrated a 28% success rate.

Minus lens therapy is designed to take advantage of a high accommodative convergence to accommodation (AC/A) ratio. Glasses or contact lenses with extra minus power are prescribed in order to stimulate accommodative convergence, thereby decreasing the exotropic deviation. Typical treatments involve -0.75 to -4.00 diopters of additional minus power above the manifest refractive error. Visual acuity, alignment, and comfort at near must be monitored regularly, as ample accommodative amplitude is required to clear additional minus.

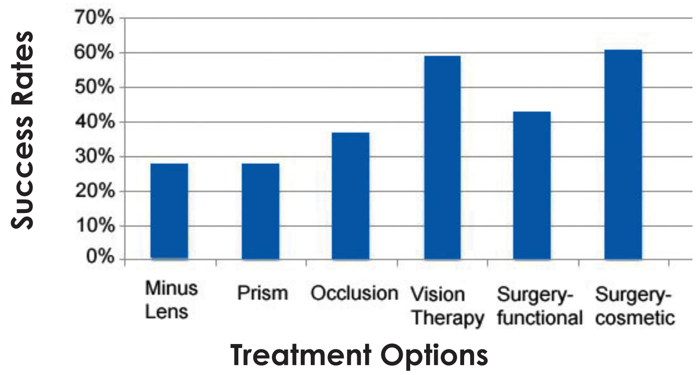
Prism therapy is a common management option that offers a high level of control for the doctor. While there are several ways to calculate the appropriate amount of base-in prism necessary for treatment, measuring the associated phoria is one of the most common. Prism can be ground-in or applied to spectacles (Fresnel) and is often combined with OVT to maximize success.

Occlusion therapy is the most common nonsurgical treatment prescribed by ophthalmologists, and probably the least common prescribed by optometrists. The basis of this treatment is to limit binocular stimulation to eliminate the need for anomalous correspondence and/or suppression. Regimens vary greatly among clinicians, ranging from one hour of patching per day to full-time occlusion. Some practitioners alternate which eye is occluded, while others choose to patch the dominant eye only. Eye care practitioner concerns include iatrogenic amblyopia and disruption of fusion potential.

OVT tends to be the most popular optometric treatment option for intermittent exotropia. Goals of an OVT program often include increasing fusional vergence amplitudes and facility, improving control of the exotropia, enhancing sensory fusion, eliminating suppression, and disrupting anomalous correspondence. OVT is an active form of treatment.

Strabismus surgery is often regarded as the treatment of choice by ophthalmologists. Surgery is prescribed most commonly when non-surgical options have failed or in large angle, high frequency exotropia. As previously mentioned, success rates differ when considering cosmetic alignment versus functional vision enhancement.

Figure 1. Successful Management of Intermittent Exotropia. Coffey et al[2]



A study performed in 1985 by Flax and Selenow [3] categorized surgical results of intermittent exotropia from 22 acceptable papers into four levels of success. Flax and Selenow adopted four categories of criteria to allow for direct comparison. The categories were functional success, motor alignment, cosmetic acceptability, and unsuccessful outcome. The definitions of the categories were:

- Functional success – post-surgically no tropia at any distance by cover test, normal motor fusion ranges at distance and near using prisms or an amblyoscope, and reported sensory fusion.
- Motor alignment – post-surgically no tropia at any distance by cover test, no improvement in sensory fusion.
- Cosmetically acceptable – post-surgical strabismus less than 15 prism diopters, regardless of binocularity.
- Unsuccessful – post-surgically unchanged or worsened.

The results of the original project were analyzed in three mutually inclusive subgroups – eight studies reported functional results, 17 studies reported nonfunctional results, and eight studies reported surgical failures. All results cited are in accordance with the previously mentioned 1985 standards.

Among the papers that cited functional data, 571 surgical patients were included. Functional success was achieved in 34.3% (196 patients), motor alignment was achieved in 27.5% (157 patients), cosmetic alignment was achieved in 16.3% (93 patients), and surgical outcome was unsuccessful in 21.9% (125 patients).

In the group of papers that only reported nonfunctional data, 919 surgical patients were included. Motor alignment was achieved in 42.0% (386 patients), cosmetic alignment was achieved in 15.8% (145 patients), and 42.2% (388 patients) of patients had an unsuccessful outcome. The papers that included surgical failures noted a 17.9% failure rate (69 patients) out of 393 surgical patients.

The purpose of this research was to recreate this study in order to compare more modern data to the original data. It would be beneficial for eye care practitioners to know both the functional and cosmetic success rates in strabismus surgery for intermittent exotropia.

Methods

A literature review of Pubmed and Visionet (Southern College of Optometry's internal search system) produced 17 acceptable papers from 1990 to 2011 that assessed surgical outcomes of intermittent exotropia. The only variable of interest for this paper was strabismus surgery outcomes; therefore, studies that combined other treatment options (such as OVT, minus lenses, or prism) were not included.

Analysis Criteria

In this updated study, the categories were allowed leniency out of necessity. The criteria were often defined by each study; therefore, they were not steadfast throughout the analysis. General guidelines for each category were:

- Functional success – generally a presence of post-surgical fusion, not necessarily an improvement from baseline. No study required an absence of tropia to be considered successful at a functional level.
- Motor alignment – no tropia post-surgically, all phorias accepted.
- Cosmetically acceptable – post-surgical strabismus less than 15 prism diopters, including esotropia.
- Unsuccessful – unable to extrapolate this data in most circumstances.

Results

Data was analyzed in three mutually inclusive subgroups – 12 included functional results, five included nonfunctional results, and five included the reoperation rate.

Among the papers that cited functional data, 1068 surgical patients were included (Table 1). Functional success was reported in 62.3% (665 patients). Motor alignment was achieved in 5.9% (63 patients), while cosmetic alignment was present in 42.5% (454 patients). Of the very few papers that included a failure rate, the total was 1.2% (13 patients).

Table 1. Functional Success Measures

Author	n =	Functional	Motor	Cosmetic	Unsuccessful
Hunter[4]	6	4 *		4	
Saunders[5]	12	4	5	4	3
Adams[6]	18	11	6	12	
Baker[7]	30	19 *			
Dadeya[8]	27	17		21	
Abroms[9]	45	42 *			
Morrison[10]	95	4 (improved)			6 (lost stereo)
Ekdawi[11]	56	25 *		31	
Maruo[12]	666	496 (simultaneous perception)		355 (4 years post-op)	
Yildirim[13]	26	17		18	
O'Neal[14]	20	12	11	6	3
Beneish[15]	67	14 (improved)	41 (no XT vs. XP)	3	1 (lost stereo)

* no mention of pre-operative stereopsis

Table 2. Motor Alignment Success Measures

Author	n =	Motor	Cosmetic
Pineles[16]	50		41
Leow[17]	48		29
Wang[18]	83		72
Ing[19]	52	32	
Kushner[20]	104	79	

Table 3. Reoperation Rates

Author	n =	Reoperation Rate
Baker [7]	30	30% (9)
Ekdawi [11]	61	19.7% (12)
Hunter [4]	5	40% (2)
Pineles [16]	50	60% (30)

Among the papers that cited only nonfunctional results, 337 patients' outcomes were analyzed (Table 2). Motor alignment was achieved in 32.9% (111 patients), cosmetic alignment was achieved in 42.1% (142 patients), and an extrapolated 25% of patients (84 patients) had an unsuccessful outcome.

The reoperation rates may be of particular interest (Table 3). As analyzed in five papers, patients requiring more than one strabismus surgery ranged from 19.7% to 60%. The number of necessary secondary surgical procedures ranged anywhere from one additional procedure upwards to four additional procedures.

Discussion

The original intention was to include research from the years 2000-2011; however, a lack of applicable papers forced the search to expand the inclusive years to 1990-2011. The most common reasons that papers were excluded were: not separating esotropia from exotropia, not separating constant exotropia from intermittent, using and comparing different types of surgical procedures (example – lateral rectus recession compared to medial rectus resection), and combining multiple treatment modalities. These complications seemed similar to challenges in the original study, as the authors found "a surprising number of papers… failed to state the criteria used… they failed to differentiate between phoria and tropia." [3]

The original goal of this study was to recreate the criteria exactly as they were in 1985. That proved to be exceptionally challenging in the modern version. Surprisingly, not a single study analyzed met the 1985 definition of functional success (defined by sensory fusion and absence of tropia). This could lead to potential debate – perhaps the original study requirements were too strenuous or perhaps today's surgical outcomes are more volatile. Arguing either side would be outside of the scope of this paper.

The summation of the 2011 functional totals do not equal 100%. This is due to the fact that some patients had to be counted twice – once for sensory findings and once for motor findings. Because of this, one cannot extrapolate the "unsuccessful" rates, unless specifically defined in the paper. However, "unsuccessful" rates were extrapolated easily in the nonfunctional results by simply adding the percentage of motor aligned and the percentage of cosmetic aligned and subtracting from 100%. Notice that the jargon has changed from "unsuccessful" to a questionably more positive "reoperation." While not the same by definition, the serendipitous finding of reoperation rates was published in an effort to maintain three categories of analysis and as an interesting aside.

Another critique is that many studies failed to report preoperative stereopsis, making it impossible to differentiate between presence of stereopsis and improvement in stereopsis. Because reporting methods differed with each paper, the overall group analysis is less meaningful than in the original study.

While there is recent literature supporting that both anesthesia and strabismus surgery are relatively safe in pediatric populations, there seems to be debate as to how many procedures are appropriate. One patient in the reviewed papers underwent a total of five surgical procedures, and the outcome was still not positive by functional standards. This is an important point for referring optometrists, whether you are an advocate for strabismus surgery or not. When referring a patient for surgery, it is important to advise the patient and his/her parents or guardians that multiple surgeries may be required. This should not be used as a point of contention meant to jab at ophthalmologists, but rather a well-documented truth that can help to prepare patients and families for the process ahead. As a co-managing optometrist, one should be prepared to help make the most of any post-surgical outcome and offer appropriate post-surgical management options.

On a positive note, only five of 22 papers (22.7%) cited in the 1985 article included some type of functional data. In the modern data, 12 of 17 papers (70.6%) included a functional vision analysis. However, functional vision analyses in the modern papers ranged greatly from simultaneous perception to improved stereopsis. Nonetheless, this paradigm could be a possible indicator that modern surgeons have more regard for post-surgical binocular status.

Conclusion

In conclusion, the results from 1985 research are impossible to recreate using modern data. The study is unattainable based on today's available literature. As optometrists, our role in strabismus surgery includes discussing all potential management options with patients and their families, making intelligent surgical referrals when appropriate, and discussing potential goals and realistic outcomes of surgery. Being educated and upfront with your patients before strabismus surgery can save you, the patient, and the surgeon from unnecessary post-surgical anguish.

An area of future research related to this topic could be a controlled experiment, in which the variable group receives both pre- and post-surgical OVT. It would be interesting to see how the functional success rates compare in patients who participate in OVT with those who undergo strabismus surgery alone.

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Date submitted for publication: 25 August 2011
Date accepted for publication: 30 November 2011