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Case Series

Globe Fixation to Nasal Periosteum with Superior Oblique Muscle Tendon in Patients with Large-Angle Exotropia

Manuela Franco[1,2], Juan Martín Grice[1,2], Juan Nicolas Barreto[1,3], Marcela Lonngi[4] and Monica Rodriguez[5,6]*

[1]*Department of Ophthalmology, Hospital Universitario de la Samaritana, Bogotá, Colombia*

[2]*Ophthalmology Trainee Program, Universidad de la Sabana, Cundinamarca, Colombia*

[3]*School of Medicine, Universidad de los Andes, Bogotá, Colombia*

[4]*Department of Ophthalmology, Pediatric Ophthalmology and Strabismus, Fundación Hospital Pediátrico la Misericordia, Bogotá, Colombia*

[5]*Department of Ophthalmology, Pediatric Ophthalmology and Adult Strabismus, Escuela de Medicina y Ciencias de la Salud, Universidad del Rosario, Bogotá, Colombia*

[6]*Department of Ophthalmology, Pediatric Ophthalmology and Adult Strabismus, Fundación Oftalmológica Nacional, Bogotá, Colombia*

***Corresponding Author:** Monica Rodriguez, Department of Ophthalmology, Pediatric Ophthalmology and Adult Strabismus, Escuela de Medicina y Ciencias de la Salud, Universidad del Rosario and Department of Ophthalmology, Pediatric Ophthalmology and Adult Strabismus, Fundación Oftalmológica Nacional, Bogotá, Colombia.

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Abstract

Aims: To report the surgical results of lateral rectus muscle (LR) recession, medial rectus muscle (MR) resection and fixation to nasal periosteum with superior oblique muscle tendon (SO) transposition in the restoration and maintenance of ocular alignment in primary position for patients with large-angle exotropia.

Methods: The medical records of patients who underwent surgery between 2009 and 2019 for large-angle exotropia treated with fixation to nasal periosteum with superior oblique (SO) transposition were reviewed. All patients underwent a preoperative assessment, including a detailed ophthalmologic examination.

Results: A total of 3 patients (age range, 14 - 48 years) with different etiologies were included. The median preoperative horizontal deviation was 95 Prism Diopter (PD) and no vertical deviation. The median postoperative horizontal residual exodeviation was 14 PD, and the vertical deviation was 8 PD in just one case. All cases were vertically and horizontal aligned within 10 PD and 20 PD of deviation, respectively.

Conclusion: Lateral rectus recession, medial rectus resection, and superior oblique transposition with nasal periosteum fixation could be used to obtain adequate anatomical and functional results in patients with large-angle exotropia, especially for patients with third nerve palsy.

Keywords: *Strabismus; Exotropia; Large-Angle Exotropia; Oculomotor Muscles; Rectus Muscles; Muscle Recession; Muscle Resection; Globe Fixation; Transposition; Oblique Muscles*

Introduction

The management of strabismus in adults is a challenge for ophthalmologists that focus their practices on the intervention of the alteration of the ocular alignment [1]. The importance of its proper treatment is centered on patients that present severe sensorial alterations followed by loss of binocular vision. This generates suppression, diplopia, and stereopsis loss [1,7,9]. Furthermore, Scatterfield., *et al.* describe the negative impact regarding the life quality of the strabic patients since they reveal serious problems of self-image, interpersonal relationships, participation in work activities, bullying, school performance, self-steam, among others [4-6,11]. The main goal to achieve in strabismus treatment is to attain the proper alignment of the visual axes to get a good function of the binocular vision and a good aesthetic appearance [3]. Either vertical or horizontal strabismus requires proper and detailed clinical evaluation to obtain the right and exact measurements for the ocular deviation, therefore obtaining positive surgical results for the patient and the surgeon [1].

In cases of exodeviations of great angle, the surgical task is greater since no matter what the grade of the divergent angle is, the surgeon has the challenge to correct the strabismus in one surgical time [21]. Up to now, there is very limited research that shows which is the best way to approach exodeviations of great angle, based on postoperative results [11].

This paper reports a series of cases that have been approached with globe fixation to nasal periosteum with superior oblique muscle tendon and carefully analyzes postoperative results applying this type of technique.

Case #1 Synopsis

48-year-old patient who had suffered head trauma with a bullet 8 years ago which penetrated through the right cervical region and lodged in the right orbit, subsequently presenting right exotropia (RXT). The patient presented best uncorrected visual acuity of 20/30 OD and 20/20 OS, on the ophthalmological examination of the anterior and posterior segment within normal limits, on the strabological and neuro-ophthalmological examination RXT of 100 prism diopters (PD) with limitation of the lateral rectus muscle of -6 (Figure 1). The magnetic resonance imaging (MRI) showed metallic splinters in the medial and inferior wall of the orbit, producing an apparent section of the right medial rectus, with a consolidated fracture of the medial wall of the orbit (Figure 2). A Hummelsheim-type procedure was performed with injection of botox in the lateral rectus. Later, in a second surgical attempt, exploration of the medial rectum (MR) muscle revealed a 12 mm retro insertion from the limbus and the presence of powder burns in its lower portion. Post-operative correction resulted in 85 PD and limiting the supra and infraduction to -3. Subsequently, a 10 mm transposition of the tendon of the superior oblique muscle to the nasal region was performed with fixation to the periosteum, in addition to a 9.0 mm middle rectus resection and 10.0 mm retro-insertion of the lateral rectus, obtaining resolution of the RXT with a right hypertropia of 10 PD 1 month after (Figure 3). The patient presented 9 months after surgery with diplopia associated to 20 PD RXT and 10 PD RHT requiring a new resection of LR, but the patient lost follow up.

Figure 1: *Ocular motility exploration before the surgery.*

Figure 2: *Axial orbit MRI before first´s patient surgery.*

Figure 3: *Ocular motility examination 1 month after the last surgery.*

Case #2 Synopsis

14-year-old male patient with congenital third nerve palsy diagnosis, myasthenia gravis and intracerebral lesions were ruled-out. The patient presented visual acuity without correction of 20/50 OU, on external exam he had ptosis in OS, the ophthalmological examination of the anterior and posterior segment without alterations. On the strabological and neuro-ophthalmological examination RXT of unmeasurable large angle exotropia > 100 PD with limitation of the MR muscle of -5 and hyperfunction of LR muscle of +2 in both eyes and compensatory vertical head torsion (Figure 4). A superior oblique muscle tendon transposition to the nasal region with fixation to the periosteum and MR resection in OU was performed. Postoperatively, the patient presented XT of 12 PD, limitation of MR of -2 and LR of -2 OU and restriction of the superior oblique in OS of - 5.

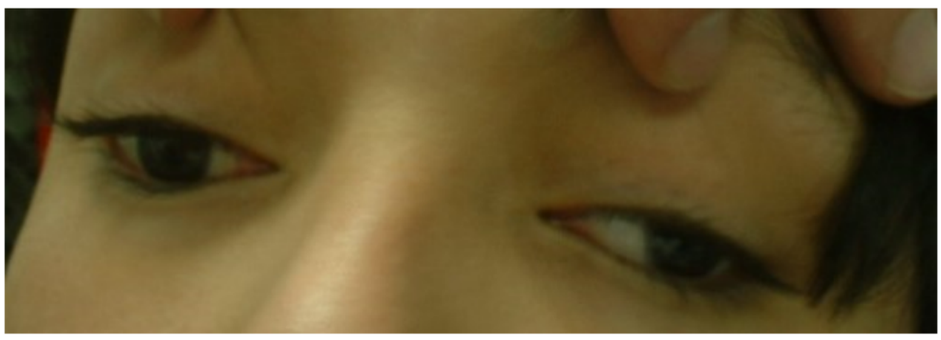

Figure 4: *Patient´s picture showing ptosis and compensatory vertical head torsion.*

Case #3 Synopsis

19-year-old female patient with congenital third nerve palsy diagnosis, the patient presented visual acuity without correction of 20/20 OD and 20/70 OS, on the ophthalmological examination of the anterior and posterior segment within normal limits. On the strabological and neuro-ophthalmological examination, left exotropia (LXT) of 85 PD was found. Right ocular motility was preserved, and in left eye examination revealed a limitation of MR muscle of -5, inferior rectus muscle -2, inferior oblique -4, and LR hyperfunction +2 (Figure 5). A transposition of the superior oblique muscle tendon to the nasal region with fixation to the periosteum and MR resection in OS was performed. Postoperatively, the patient presented LXT of 10 PD, limitation of MR muscle of -2, superior rectus muscle (SR) of -4 and in LR muscle of -2 OS (Figure 6).

Figure 5: *Ocular motility examination before surgery.*

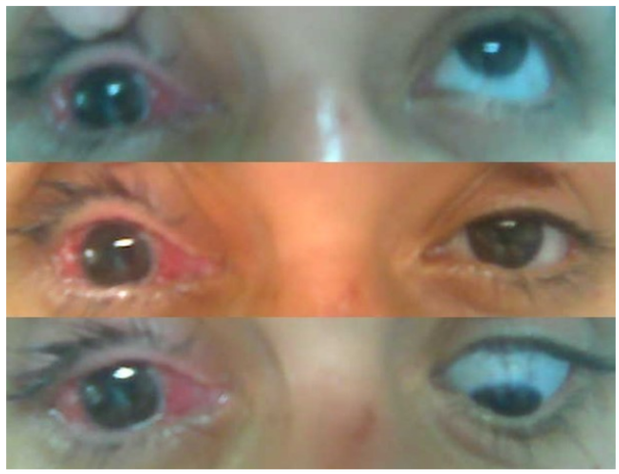

Figure 6: *Ocular motility examination after the surgery.*

Etiology	Age	VA affected eye	Pre-op	Surgical technique	1 month follow up	Last follow up
1. Trauma	48	20/30 OD	RXT 100	Superior oblique muscle tendon nasal transposition with R+R procedure	HT 8	HT 8, XT 20 (9 months)
2. Congenital CN3 palsy	19	20/50 OU	RXT >100	Superior oblique muscle tendon nasal transposition with R+R procedure	XT 12	XT 12
3. Congenital CN3 palsy	14	20/70 OS	LXT 85	Superior oblique muscle tendon nasal transposition with R+R procedure	XT 10	XT 10 (96 months)

Table 1: *Patient's summary.*

Discussion

Large-angle exotropia remains a challenge for pediatric ophthalmologists and strabismus specialists, regardless of the several decades of invention and implementation of surgical techniques for the correction of this disease entity [1]. It requires a careful and personalized evaluation to determine the most appropriate approach. There is no global consensus for the definition of large-angle exotropia, but the literature describes values in ranging from 40 to 60 PD [2]. Strabismus, especially large angle exotropia, has a high impact on the quality of life, since it affects the way in which patients see themselves and are perceived by others in society [3-5]. It has been seen and proven that surgical treatments in these patients not only improve the psychosocial well-being of the patient but in certain cases it is possible to restore binocular vision, which would result in a higher quality of life in these patients [6-8].

Another challenge that constitutes the surgical treatment of exodeviations is that there are no exact guidelines for the management of these patients. There are different types of procedures that can be performed in one or two surgical stages where two, three or four muscle surgeries have been described. Another challenge is that there are no exact criteria for success, and it varies widely in literature. Most consider motor results only, with surgical success being ocular alignment of 5 to 15 PD and success rates being reported from 42.9% to 88.2% [9-11].

In recent studies, the exodeviation surgery is divided into two general approaches. The first, a bilateral lateral rectus recession, which is preferred when there is good visual acuity in both eyes. It remains the most used procedure since it has been shown to prevent limitations to eye movements, which occurs in large-scale surgeries [11]. Whereas a maximal or supramaximal unilateral recess–resect procedure is performed if one eye is amblyopic [12,13]. Some physicians may also include procedures to weaken the obliques depending on the pattern on different gaze positions [14,15]. Also, some choose to achieve on two horizontal muscles and correct residual deviations with a second or third procedure. Others prefer a simultaneous four horizontal muscle surgery [16,17].

Schwartz., *et al*. proposed that two muscle surgery was sufficient for large angle exotropia, with 77% of their 22 cases achieving a postoperative alignment of a mean 15 PD [20]. Livir-Rallatos found in 63 cases that two-muscle surgery was appropriate for exodeviations up to 50 PD with a success rate of 71%, but not for larger than 50 PD in which the success rate significantly decreased to 18% [21]. Similarly, Ganguly., *et al*. reported an 83.3% success rate in 48 adults with approximately 40 - 80 PD exodeviation as achieved with unilateral two-

muscle surgery [10]. They concluded that two muscle surgery may be used with success for medium angle exotropia, meanwhile, three or four muscle procedures may be needed for the very large-angle exotropia. Li., *et al*. achieved similar results, by analyzing a cohort of 23 patients with a mean exotropia of 130 PD, reporting a success rate of 83% using three-muscle surgery [22]. As mentioned above, some ophthalmologists may prefer the one-stage surgical procedure, such as Lau., *et al*. reporting success rate of 88.2% with one-stage three muscle surgery in 24 patients with > 60 PD exotropia.

The first to describe the technique of anchoring the globe to the nasal periosteum was in 1994 by Salazar-León., *et al*. in which they sutured one end of fascia lata to the medial aspect of the globe and other to the nasal periosteum [18]. In addition, they also made a large lateral rectus muscle recession. This technique was inexpensive, but it leaves a scar that could cause long term complications. Later in 2000, Villaseñor Solares., *et al*. described the use of the superior oblique tendon to secure the fixation to the globe in which they use approximately 12 to 14 mm of the superior oblique tendon, fixed with mersilene suture. The tendon length adjusted to fixate the globe in primary position in the first few cases. They also made a maximal recession of the lateral rectus and resection of the medial rectus [19].

Here we report the results of 3 cases with a large-angle exotropia treated with superior oblique muscle tendon transposition, MR resection and LR recession. Two of these cases had a great outcome with complete resolution of diplopia and good alignment in a long term follow up. However, case number 1 showed a 20 PD XT and diplopia 10 months after surgery, requiring reintervention. Satisfactory motor outcomes were obtained in both patients with congenital third palsy. To the best of our knowledge, there is not another case series evaluating this technique for large-angle exotropia. Additionally, we include a patient with traumatic exotropia that did not have a good outcome and make us consider that this procedure would be more advisable for patients with third nerve palsy.

Conclusion

Superior oblique muscle tendon transposition with nasal periosteum globe anchoring along with lateral rectus recession and medial rectus resection, could be used to obtain adequate physical and functional results in patients with large-angle exotropia regardless of the etiology. Additionally, we advise to perform an extraocular muscle exploration in those cases in which the functionality, insertion or size of the muscle is not totally clear, such in traumatic etiologies, in order to corroborate and complement the diagnostic images results.

Conflict of Interests

Authors declare no conflict of interests.

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