

## Artículo original

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# Plegamiento ajustable de rectos laterales en el tratamiento del Sagging Eye Syndrome

*Adjustable plication of lateral rectus muscles in the treatment of Sagging Eye Syndrome*

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### Resumen

**Propósito:** Analizar la efectividad de este procedimiento quirúrgico. **Materiales y método:** Estudio retrospectivo de 15 pacientes con esotropía por insuficiencia de divergencia operados entre 2016 y 2021 por un solo cirujano. **Criterios de inclusión:** Adultos mayores con esotropía (ET) para lejos mayor que para cerca o con ortoforia para cerca, diplopía para lejos y visión binocular normal. ET promedio para lejos 14.33; desviación estándar 6,83 (max 30 y min 7). Promedio de edad 72 años (Min 59 y Mx 89), siendo mujeres el 62,5%. La cirugía de todos los pacientes fue plegamiento de rectos laterales con técnica de suturas ajustables en un ojo. Se utilizó anestesia general en 13 pacientes y local tópica o sub tenoniana en 2, con ajuste de la sutura a las 24 hs con anestesia tópica. Seguimiento quirúrgico mayor de 2 meses. **Resultados:** Resolución de diplopía en el 100% de los pacientes después del ajuste posoperatorio. Esotropía posoperatoria promedio 1,47; Desviación st 2.10 (max 6, min 0). **Conclusiones:** Control de diplopía en todos los paciente utilizando la técnica de plegamiento muscular con suturas ajustables, haciendo de esta cirugía de primera elección en el Sagging Eye Syndrome, incluso en pequeños ángulos de desviación.

**Palabras clave:** Plegamiento ajustable/recto lateral/sagging eye Syndrome/esotropía de lejos/diplopía.

### Summary

**Purpose:** To analyze the surgical outcomes of this procedure. **Material and Method:** A retrospective chart review of fifteen patients with divergence insufficiency esotropia who were operated on between 2016 and 2021 by one surgeon. **Inclusion criteria:** older adults with esotropia (ET) for distance greater than for near or with orthophoria for near; diplopia for distance and normal binocular vision. ET for average distance 14.33; st deviation 6.83 (max 30 and min 7). Average age was 72 years (Mn 59 and Mx 89) with 62.5% women. All patients underwent surgery with lateral rectus plication, using the technique of adjustable suture in one eye. General anesthesia was used in 13 patients and local topical or sub-Tenon anesthesia in 2, with suture adjustment performed at 24 hours under topical anesthesia. Postoperative follow-up greater than 2 months. **Results:** Diplopia resolved in 100% of patients after postoperative adjustment. Average postoperative esotropia 1.47;

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st deviation 2.10 (max 6, min 0). **Conclusions:** Diplopia was corrected in all of these patients using the lateral rectus plication technique with adjustable suture, making this surgical approach a first choice alternative in Sagging Eye Syndrome, even in small angles of deviation.

**Key words:** *Adjustable plication/lateral rectus /sagging eye/distance esotropia/diplopia.*

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## INTRODUCTION AND OBJECTIVE

Sagging Eye Syndrome (SES) also named Adult Divergence Insufficiency Esotropia (ADIE), or Age Related Distance Esotropia (ARDE), is an acquired esodeviation greater at distance than at near that affects adults above 60 years. It was first time described in 2006 by Mittelman (1).

SES is the most common cause acquired binocular non-paralytic diplopia in elderly adults (2).

Its rate increases with age, with 60% of the patients being women.

Orbital connective tissues play an important role in eye movements, and their abnormalities can cause strabismus. Connective tissues couple the extraocular muscles to the orbital walls and to one another. Each rectus muscle is encircled by a pulley, a ring of primarily collagenous connective tissue located posterior to the globe equator and contiguous with Tenon's fascia. Pulleys inflect rectus muscle paths, such band, the lateral rectus -superior rectus (LR-SR) band, joins the lateral and superior rectus muscles.

Degeneration of orbital connective tissues occurs with aging. Degeneration of the LR-SR band may also occur in elderly people, allowing inferior displacement of the lateral rectus pulley and muscle. Also the lateral rectus pulley and muscle are under the tension of the inferior oblique muscle, whose orbital layer inserts on the lateral rectus pulley. Expecting these subjects to exhibit esotropias or hypotropias and supraduction deficits. Asymmetrical inferior shift of the LR pulley has been postulated to produce cyclovertical strabismus (3).

Inferior displacement of the lateral rectus muscle is also a well-recognized cause of strabismus in high myopes, known as «heavy eye» syndrome (HES).

SES exhibits superotemporal soft tissue prolapse that may limit superotemporal globe shift.

Orbital MRI demonstrates inferior lateral rectus displacement and medial superior rectus displacement with severe superotemporal prolapse of the myopic globe in HES, whereas only inferior displacement of the lateral rectus results from degeneration of the LR-SR band is seen in SES.

The affected lateral rectus muscle belly is tightly apposed to the prolapsing globe in HES but it is widely separated from the globe by orbital fat and lacrimal gland in SES.

However, in both HES and SES, the LR-SR bands are either elongated or ruptured (4).

MRI study was the highly significant displacement of all 4 rectus pulleys away from the orbital center in SES.

Microscopy has demonstrated progressive elongation and rupture of the LR-SR band ligament with age, associated with LR pulley sag.

Patients with SES exhibit symmetrically limited supraduction, although all exhibit full horizontal ductions and clinically normal horizontal saccadic eye velocities. If such patients seek care for acute or chronic horizontal binocular diplopia for distance but not near targets, as is characteristic of Divergence Paralysis Esotropia, in the absence of associated neuropathology.

Asymmetrical inferior shift of the LR pulley has been postulated to produce cyclovertical strabismus so in SES the hypotropic eye is ex-cyclotropic.

SES represents a mechanical cause of acquired, adult horizontal and vertical strabismus (5).

Considering all the above, the technique proposed in this study consists in the adjustable plication of the lateral rectus muscle.

The adjustable suture technique for strabismus is a method in which the extraocular mus-

cle may be repositioned and thus the surgical dosage altered posoperatively, with the intent to improve both short and long term outcomes by reducing under or over corrections.

Muscle adjustable plication allows to shorten a muscle achieving the desire orthophoria 24 hours later and without altering the circulation of the anterior segment of the eye. Anterior ciliary arteries provide 70% of the vascular supply of the anterior segment. Interruption of the vascular flow of these arteries increases the risk for anterior ischemia. In a case of high risk for anterior ischemia an adjustable muscle plication technique is a good option.

By doing plication with adjustable sutures using non-resorbable suture we can graduate this shortening. We use non-resorbable sutures because, by not cutting the muscle, there is no adhesion to the sclera being the suture that ensures the desired shortening. The material used is polyester fiber 6-0 suture, double arm spatula needle (polyethylene tereftalate, Mersilene).

All patients underwent strabismus surgery, with general (propofol and remifentanil) or topical anaesthesia (proparacaine hydrochloride 0.5%). Limbal conjunctival flap is performed.

The muscle to be plicate is repaired using two strabismus hooks and the non-absorbable mersilene is placed, passing the suture in the same way as it is done in the adjustable setbacks at 5 or 8 mm from the muscle insertion according to desired adjustable plication amount. Then the needles are inserted through the insertion of the muscle in the sclera and the risk of perforation is eliminated.

The adjustment is performed 24 hours after the surgery ended under 1% lidocaine topical anaesthesia wearing the required refractive correction, and the alignment monitoring by cover test for distance. After that, the conjunctiva is reposed to the limbus.

We have been performing this technique for strabismus surgery since 1999 and the first results were presented at the VI Meeting of Disciples of Dr. Ciancia and III International Symposium of the Brazilian Society of Pediatric Ophthalmology in Brazil, March 2001 and then published in the CLADE Bulletin in December 2002, with the description of the surgical technique. This technique is also described in the Strabismus Module of the Distance Master's Degree in Ophthalmology, Consejo Argentino

**Table 1. Sex, Age, Time of evolution of diplopia (years), Screen test for far and near before surgery (dp), Screen test for far and near one month after surgery (dp).**

Pat.	Sex	T. of Evol.	ST far pre-Surg.	ST near pre-Surg.	ST far post-Surg.	ST near post-Surg.
1	F	10	ET 10 V+4	ET 25 V+4	ET 6	X(t) 8
2	F	4	ET 25 V+1	ET 16 V+1	0	V-2
3	M	1	ET 14 V+3	0	E 2	X 3
4	F	8	ET 17 V+10	ET 2 V+6	0	XT 8 V+2
5	M	1	ET 20 V+2	ET 6-8	0	0
6	F	1	ET 18 V+2	E8	ET 4-6 V+2	X 2-0
7	M	1	ET 8 V-4	ET 2	ET 2 V-1/2	XT 2 V-1
8	F	5	ET 18 (V+2)	E 9	0	X4
9	M	4	ET 10 V+4	E 6	0	0
10	M	4	ET 10	E 5	E 3	X 2
11	M	4	E 7	X 2 V+2	0	0
12	F	4	ET 10	X 3	0	X 5
13	F	0,5	ET 10 V+2	O- X 2	E 4 V+3	V+3
14	F	10	ET 8 V-4	X2 V+1	0	X 5
15	F	20	ET 30 V-2	ET 18	0	X 2

PAT: patient; T. OF EVOLUTION: time of evolution; ST FAR PRE-SURG: Screen test far pre-surgical; ST NEAR PRE-SURG: Screen test near pre-surgical; ST FAR POST-SURG: Screen test far post-urgical; ST NEAR POST-SURG: Screen test near post-urgical.

de Oftalmología and Universidad Católica de Salta, Argentina; sixth cycle, pages 345-346, year 2010 and in the 2011 Joint Meeting, American Academy of Ophthalmology. Orlando, USA, October 24th, 2011 (6,7).

The objective of this retrospective study is to review the results of adjustable lateral rectus muscle surgery to assess the suitability of performing it as the first option in patients diagnosed with SES, even in deviations of less than 10 dp (8).

## MATERIAL AND METHOD

A retrospective chart review of fifteen patients with SES who were operated on between 2016 and 2021 by one surgeon, Ofelia Brugnoli de Pagano.

The inclusion criteria were older adults with esotropia (ET) for distance greater than for near or with orthophoria for near; diplopia for distance and normal binocular vision. The diagnosis of SES was made through the symptoms reported by the patients and the findings in the examination, including a Sensory Motor Study and Hess Lancaster test.

The following data was collected for later analysis: age, sex, number of months from the appearance of symptoms to the strabismus consultation, amount of angle of deviation with prisms at 5 meters in primary position, and angle of deviation at 33 cm. The amount of distance and near deviation was also assessed one month after surgery. Surgical success was considered to be the disappearance of diplopia in all gaze positions (table 1).

All patients underwent surgery with lateral rectus plication, using the technique of adjustable suture in one eye. Of the 15 patients, 8 underwent surgery with plication of both lateral rectus, using the adjustable suture technique in one eye only, and 7 underwent resection of the lateral rectus of one eye and plication of the lateral rectus (from 5 to 8 mm ) with adjustable suture from the other eye.

General anesthesia was used in 13 patients and local topical and local anaesthesia in 2,

with suture adjustment performed at 24 hours under topical anesthesia. Postoperative follow-up greater than 2 months.

## RESULTS

Resolution of diplopia was achieved after postoperative adjustment in 100% of the total of 15 patients who were included in this retrospective study. The average postoperative esotropia was 1.47; st deviation 2.10 (max 6, min 0).

The average preoperative esotropia for distance 14.33; st deviation 6.83 (max 30 and min 7). Average age was 72,4 years (Mn 53 and Mx 89) with 60% women. The average number of years between the appearance of symptoms and the consultation was 4.14 yrs. (Mn 0.5 and Mx 20).

## CONCLUSIONS

This entity that was first described in 2006 by Mittelman (1), is already recognized as the most common cause of binocular diplopia in patients older than 60 years (2).

Treatment for SES includes prisms prescription and/or strabismus surgery.

Chauduri and Demer proposed medial rectus recession bilaterally or unilaterally. Medial rectus recession is an effective surgical treatment when augmented recession amounts are employed. The findings that surgical dose-response was relatively low but increased with preoperative angle suggest a mixed mechanism of chronic lateral rectus weakness combined with reduced medial rectus elasticity. (5) The authors proposed medial rectus recession that is reversible and convenient for intraoperative adjustment under topical anesthesia, and it is as effective as lateral rectus resection. In their report, adjustable lateral rectus resection was effective for correcting ADIE and did not cause consecutive exotropia. (10)

Breidenstein and col. (9) stated that both medial rectus recession and lateral rectus resection are effective treatments for divergence insuffi-

ciency, and both reduce the disparity between distance and nearness.

Wright (8) proposed central lateral rectus plication (LRCP) as a minimally invasive tightening procedure first described in 2012, and compared it to medial rectus recession (MRR) in the treatment of divergence insufficiency esotropia in adults. He concluded that both procedures had excellent primary results, eliminating diplopia in more than 90% of cases. This procedure has the advantage of being minimally invasive, semi-reversible, vessel-sparing, and can be performed under topical anesthesia.

In conclusion, regarding the types of surgeries, several options have been used: debilitating surgeries of the medial rectus, reinforcement of the lateral rectus such as resections or plications, and also combinations of both. Acting on the lateral rectus is an approach more in line with the pathogenesis of this entity and, on the other hand, seems to affect the near angle less than if the medial rectus is weakened. In addition to this, the technique that we propose guarantees a second chance to achieve with greater precision, by adjusting the suture of the plication of the lateral rectus muscle at 24 hours, the total loss of diplopia in distant vision, being able to conserve the irrigation that this muscle contributes to the anterior segment.

For all the above, we believe that surgical treatment based on the plicating of the lateral rectus, using the adjustable suture technique in this entity, allows for the elimination diplopia immediately, being a therapeutic option that we believe should be evaluated in all cases, even with small deviations, allowing a clear improvement in the quality of life of all patients.

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