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## Original article

# Outcomes of minimally invasive strabismus surgery for horizontal deviation<sup>☆</sup>



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### ARTICLE INFO

#### Article history:

Received 19 May 2015

Accepted 5 November 2015

Available online 22 February 2016

#### Keywords:

Minimally invasive strabismus surgery

Horizontal strabismus

Recessions

Resections

Plications

### ABSTRACT

**Objective:** To study the outcomes of minimally invasive strabismus surgery (MISS) for treating horizontal deviation.

**Method:** Case Series of the first 26 consecutive patients operated on using the MISS technique in our hospital from February 2010 to March 2014.

**Results:** A total of 40 eyes were included: 26 patients (mean age: 7.7 years old  $\pm$  4.9); 34.61%: male. A total of 43 muscles were operated on: 20 medial, and 23 lateral recti; 28 recessions (range: 3–7.5 mm), 6 resections (6–7 mm), and 9 plications (6.5–7.5 mm) were performed. No significant difference was found ( $p > 0.05$ ) for visual acuity at postoperative day 1, and 6 months after surgery. A mild hyperaemia was observed in 29.27%, moderate in 48.78%, and severe in 21.95% at postoperative day 1 and in 63.41%, 31.70% and 4.87%, respectively, at 4 days after surgery. The complications observed were 4 intraoperative conjunctival hemorrhages, 1 scleral perforation, and 2 Tenon's prolapses. A conversion from MISS to a fornix approach was necessary in 1 patient because of bad visualization. The operating time range decreased from 30 to 15 min.

**Conclusions:** The MISS technique has obtained good results in horizontal strabismus surgery. The conjunctival inflammation was mild in most of the cases at postoperative day 4. The visual acuity was stable during follow-up, and operating time decreased after a 4-year learning curve.

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## Resultados de la cirugía de estrabismo mínimamente invasiva en las desviaciones horizontales

### RESUMEN

**Objetivo:** Estudiar los resultados de la cirugía de estrabismo mínimamente invasiva (MISS) en desviaciones horizontales (DH).

**Método:** Serie de los primeros 26 casos consecutivos operados de estrabismo horizontal en nuestro hospital mediante MISS desde febrero de 2010 a marzo de 2014.

#### Palabras clave:

Cirugía de estrabismo

mínimamente invasiva

Estrabismo horizontal

<sup>☆</sup> Please cite this article as: Merino P, Blanco Domínguez I, Gómez de Liaño P. Resultados de la cirugía de estrabismo mínimamente invasiva en las desviaciones horizontales. Arch Soc Esp Oftalmol. 2016;91:69–73.

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Recesiones  
Resecciones  
Plegamientos

**Resultados:** Se incluyeron 40 ojos: 26 pacientes (edad media: 7,7 años [DS: 4,9]; 34,61%: hombres). Se operaron 43 músculos: 20 rectos medios y 23 rectos laterales; 28 recesiones (rango: 3-7,5 mm), 6 resecciones (rango: 6-7 mm) y 9 plegamientos (rango: 6,5-7,5 mm). Se encontraron diferencias estadísticamente significativas ( $p < 0,001$ ) en la desviación horizontal en dioptrías prismáticas pre y poscirugía, con un 88,46% de buenos resultados (desviaciones finales  $\leq 10$  dioptrías prismáticas). No se hallaron diferencias estadísticamente significativas ( $p > 0,05$ ) en la AV al día siguiente de la cirugía y a los 6 meses. Un 29,27% de los ojos presentó hiperemia leve, 48,78% moderada y 21,95% severa al primer día postoperatorio, pasando al cuarto día al 63,41%, 31,70% y 4,87% respectivamente. Las complicaciones fueron 4 casos de sangrado conjuntival intraoperatorio, una perforación escleral y 2 prolapso de Tenon. En un caso hubo que reconvertir a incisión fornix por mala visualización. El rango del tiempo quirúrgico disminuyó desde 30 a 15 min por músculo.

**Conclusiones:** La MISS ha obtenido buenos resultados en la cirugía del estrabismo horizontal. La inflamación conjuntival es leve en la mayoría de los casos a los 4 días de la cirugía. La AV se mantiene estable y el tiempo quirúrgico va disminuyendo una vez superada la curva de aprendizaje de 4 años.

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## Introduction

Minimally invasive strabismus surgery (MISS) is a technique described by Mojon in 2007 for operating strabismus.<sup>1</sup> The first surgeries were performed on horizontal rectus but other MISS procedures were subsequently published which described the advantages of minimally invasive surgery.<sup>2-6</sup> These include less inflammation in the immediate postop (1-15 days), which enhances visual acuity (VA) and less postop discomfort. On the other hand, by reducing the disruption between the muscle and the perimuscular tissue (sheaths and tenon's capsule), surgical field adherences diminish, thus facilitating re-interventions. Finally, MISS preserves perilimbar vascularization thus diminishing the risk of anterior segment ischemia.<sup>3</sup> Other modifications proposed by the same author are trans-conjunctival suture (TRASU) and marginal dissection (MADI) instead of total dissection (TADI), which enables an even smaller incision size as well as reducing tissue disruption and surgery time.<sup>7,8</sup> The main drawback of MISS is an excessively long learning curve.<sup>9</sup>

According to Mojon, the main complications of MISS include 5% of hemorrhages that require conversion to limbar incision,<sup>1</sup> even though said author also reported 8.4% in the early days of MISS, with greater incidence of resections.<sup>6</sup>

The objective of this article is to study the results and complications of MISS in horizontal deviations (HD).

## Patients, material and methods

A descriptive, retrospective study of the first 26 consecutive patients operated for horizontal strabismus with the MISS technique between February 2010 and March 2014. The study was approved by the ethics committee of the hospital and data collection was made in accordance with the Helsinki protocol.

The study included recessions, resections and folds of the middle and lateral rectus of cases who did not undergo surgery

during the 6 last months for other strabismus surgeries, with the proviso that the muscles operated with MISS had not undergone previous surgery. The study excluded patients in whom other muscles were intervened in the same surgery, muscles other than the middle and the lateral rectus, as well as those with a follow-up time below 6 months.

The surgeries were always performed by 2 surgeons (PM and/or PGL), with general anesthesia, microscope and assistant. The conjunctival incisions were performed following the technique described and published by Mojon.<sup>1</sup> The limbar traction of the eye was performed with a 6-0 silk suture (Ethicon) for better surgical field exposure. In recessions above 4 mm, hanging suture from the original muscle insertion was used due to the difficulty in accessing the scleral area that provided the smallest conjunctival incision. The muscular suture was 6-0 vycril (Ethicon) and the conjunctival incisions were stitched with 8-0 silk (Lorca Marin) with 1 or 2 stitches in every conjunctival buttonhole. At the end of the surgery, 5% iodine povidone was instilled, followed by a few drops of Tobradex® (Alcon Cusi, Barcelona) in the operated eyes, which was maintained during 15 days post-surgery (4-5 times/day).

The following clinical data of patients was collected: pre-and post-surgery VA between the first and third day; hyperemia, conjunctival edema and palpebral edema between days 1-3 and 7-10 days after surgery; and surgical time (ST) elapsed in the operation of every muscle since beginning the conjunctival incision up to closing with the last conjunctival stitch. The patients were examined between 1-3 days, 7-10 days, one month, 3 and 6 months after surgery by the same surgeons who performed the operations. The conjunctiva was examined macroscopically with direct visualization as well as microscopically (with slit lamp) in primary gaze position (PGP) and in horizontal versions. Hyperemia, conjunctival and palpebral edema were classified as 0: absent (no hyperemia in PM), 1: slight (localized hyperemia over 1 mm away from the limbus), 2: moderate (hyperemia reaching the corneal limbus) and 3: severe (any grade of hyperemia with conjunctival chemosis and/or sub conjunctival hemorrhage).

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