

Original Article

Surgical Outcomes of Strabismus Patients Undergoing Intraoperative Adjustable Surgery. Retrospective Study

Resultados Quirúrgicos de Pacientes Estrábicos sometidos a Cirugía ajustable intraoperatoria. Estudio retrospectivo de corte transversal

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ABSTRACT

Objective: To evaluate the surgical outcomes of strabismus patients undergoing intraoperative adjustable surgery under topical anesthesia alone or combined anesthesia. **Methods:** Observational, descriptive, retrospective, cross-sectional study. A total of 77 patients who underwent surgery between 2001–2005 and 2013–2021 were included. Demographic characteristics, diagnosis, type of anesthesia, preoperative deviation, immediate postoperative and 6-month postoperative deviations, and intraoperative complications were analyzed. **Results:** The mean age was 27 years, and 52% were male. Forty-five percent received topical anesthesia alone with 0.5% proparacaine hydrochloride, whereas 55% received combined topical anesthesia with sub-Tenon's 2% lidocaine and propofol sedation. The mean preoperative deviation was 39.99 prism diopters (PD), which was reduced to 1.86 PD in the immediate postoperative period and to 3.78 PD at 6 months. Surgical success was 99% in the immediate postoperative period and 92% at 6 months. The most frequent complication was pain during muscle traction (47%), occurring predominantly in patients who received topical anesthesia alone. **Conclusion:** Intraoperative adjustable surgery is a safe, effective, and reproducible technique for the treatment of strabismus in cooperative adult patients. It allows more precise ocular alignment, avoids systemic complications associated with general anesthesia, and reduces the need for reoperations.

Keywords: strabismus; ocular alignment; adjustable sutures; topical anesthesia; propofol; intraoperative adjustable surgery.

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RESUMEN

Objetivo: Evaluar los resultados quirúrgicos de pacientes estrábicos sometidos a cirugía ajustable intraoperatoria bajo anestesia tópica sola o combinada. **Métodos:** Estudio observacional, descriptivo, retrospectivo, de corte transversal. Se incluyeron 77 pacientes operados entre 2001–2005 y 2013–2021. Se analizaron características demográficas, diagnóstico, tipo de anestesia, desvío preoperatorio, postoperatorio inmediato y a los 6 meses, y complicaciones intraoperatorias. **Resultados:** La edad promedio fue de 27 años; 52% hombres. El 45% recibió anestesia tópica sola de clorhidrato de proparacaína al 0.5%, y el 55% anestesia tópica combinada con subtenoniana de lidocaína al 2% y sedación con propofol. El desvío preoperatorio promedio fue de 39,99 dioptrías prismáticas (DP), reduciéndose a 1,86 DP en el postoperatorio inmediato y a 3,78 DP a los 6 meses. El éxito quirúrgico fue del 99% en el postoperatorio inmediato y del 92% a los 6 meses. La complicación más frecuente fue dolor a la tracción muscular (47%), principalmente en pacientes con anestesia tópica sola. **Conclusión:** La cirugía ajustable intraoperatoria es una técnica segura, eficaz y reproducible para el tratamiento del estrabismo en adultos colaboradores. Permite un alineamiento más preciso, evita complicaciones sistémicas asociadas a la anestesia general y reduce la necesidad de reintervenciones.

Palabras clave: estrabismo, alineamiento ocular, suturas ajustables, anestesia tópica, propofol, cirugía ajustable intraoperatoria.

Introduction

Etymologically, the word *strabismus* derives from the Latin *strabismus*, which in turn originates from the Greek *strabós*, meaning twisted or squinting eye. Strabismus is characterized by the loss of parallelism between the visual axes due to abnormalities in binocular vision or neuromuscular control, resulting in both motor and sensory disturbances. It may develop during childhood or later in adulthood ⁽¹⁾.

Strabismus is classified according to several factors that define its specific characteristics and help establish the diagnosis or clinical subtype. It may be primary (congenital or familial) or secondary to ocular or systemic diseases. The most common types are convergent deviations, referred to as esotropia or endotropia; divergent deviations, referred to as exotropia; and vertical deviations, classified as hypertropia (upward deviation) and hypotropia (downward deviation), according to the direction of ocular misalignment. Other forms of strabismus have distinctive characteristics, such as oculomotor palsies involving the fourth, sixth, and third cranial

nerves. Additional types include consecutive or residual deviations following previous strabismus surgery, in which overcorrection or undercorrection of the original deviation occurs.

Among esotropias, infantile esotropia is the most common, whereas among exotropias, intermittent exotropia, which develops during early childhood, is the most frequent ⁽²⁾.

Surgery is the treatment of choice for most clinical forms of strabismus, with the objective of restoring parallelism or ocular alignment (orthotropia) and, whenever possible, recovering binocular sensory function. Surgical techniques are based on modifying the function of the extraocular muscles through weakening procedures such as recessions, myotomies, or tenotomies, or strengthening procedures such as resections, advancements, or muscle transpositions, depending on the magnitude and type of deviation ^(3,4).

The development of safer anesthetic techniques has expanded the possibilities for strabismus surgery. General anesthesia, once

widely used, has largely been replaced in adults by local anesthesia with sedation, particularly using propofol, because of its rapid onset and minimal interference with muscle function⁽⁵⁻⁷⁾. Topical anesthesia alone or combined with sedation, including sub-Tenon's anesthesia, has gained importance in extraocular muscle surgery in which intraoperative evaluation of ocular alignment is required⁽⁸⁻¹⁰⁾.

Intraoperative adjustable surgery allows modification of muscle position during the procedure by evaluating ocular alignment while the patient is awake, using tests such as the Hirschberg test (corneal light reflex test) or the cover-uncover test^(9,10). This technique offers advantages in complex, residual, consecutive strabismus and oculomotor palsies, allowing more precise correction while reducing the need for reoperations (**Figures 1, 2, 3, and 4**).

In Paraguay, there are no published studies on intraoperative adjustable surgery performed under topical anesthesia alone or combined anesthesia, highlighting the importance of this study in providing local evidence and serving as a basis for future research.

The **general objective** of this study was to evaluate the surgical outcomes of strabismus patients who underwent intraoperative adjustable surgery between 2001–2005 and 2013–2021.

The **specific objectives** were: to describe the surgical technique used; to classify the types of strabismus treated; to compare the preoperative deviation with the immediate postoperative deviation and the deviation at 6 months; and to identify complications associated with the procedure.



Figure 1. A, Esotropia due to acquired left sixth cranial nerve palsy (post-traumatic) with limitation of left eye abduction. B, Following surgery, the patient achieved orthotropia (normal ocular alignment) with normal left eye abduction. **Image attribution:** Authors' own patient image archive.

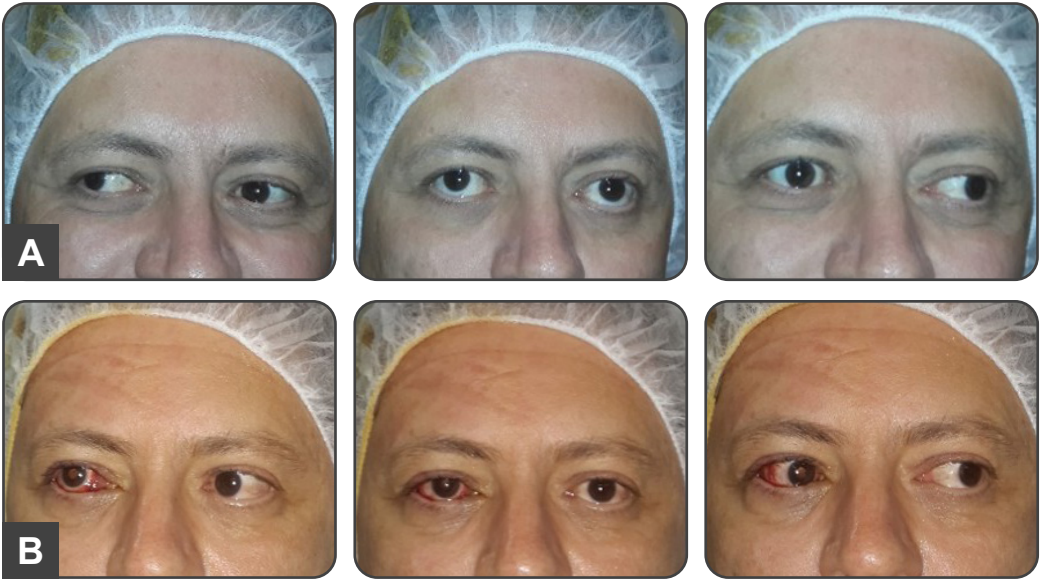


Figure 2. Patient with consecutive exotropia following surgery for esotropia during childhood. **A**, Exotropia in the primary position of gaze and in lateral gaze. **B**, Immediately after intraoperative adjustable surgery, showing orthotropia and improved ocular versions. **Image attribution:** Authors' own patient image archive.

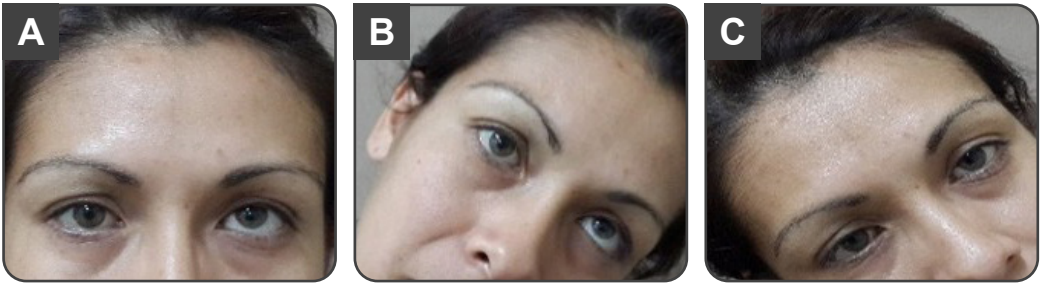


Figure 3. Congenital fourth cranial nerve palsy of the left eye in an adult patient. **A**, Left hypertropia in the primary position of gaze. **B**, Hypertropia of the affected eye with head tilt to the left, demonstrating a positive Bielschowsky head tilt test. **C**, Absence of hypertropia of the affected eye with head tilt to the right. **Image attribution:** Authors' own patient image archive.



Figure 4. Postoperative outcome. **A**, Orthotropia. **B**, Negative Bielschowsky head tilt test. **Image attribution:** Authors' own patient image archive.

Materials and Methods

An observational, descriptive, retrospective, cross-sectional study was conducted using a non-probabilistic consecutive case sampling method.

The accessible population consisted of patients diagnosed with primary and secondary strabismus, oculomotor nerve palsies, and residual or consecutive strabismus following previous strabismus surgery.

The study was divided into two periods due to the author's absence from the country between

these periods for subspecialty training. The first period extended from 2001 to 2005, and the second from 2013 to 2021.

Data were collected from 77 patients who underwent intraoperative adjustable strabismus surgery and met the inclusion and exclusion criteria established in the research protocol. Patients were treated at the Hospital de Clínicas and a private ophthalmology clinic (Table 1).

It should be noted that the main limitations of the study were the loss of medical records or incomplete clinical information, particularly

Table 1. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
1. Adolescent and adult patients ≥ 14 years of age.	1. Pediatric patients < 14 years of age.
2. Both sexes.	2. Patients who underwent conventional strabismus surgery under general anesthesia or peribulbar local anesthesia without intraoperative adjustment.
3. Patients who underwent intraoperative adjustable surgery under topical anesthesia alone or assisted by propofol sedation and/or sub-Tenon's anesthesia.	3. Patients with neurological disorders or who were unable to cooperate during surgery.
4. Patients diagnosed with primary or secondary strabismus, oculomotor palsies, residual strabismus, or consecutive strabismus following previous strabismus surgery.	4. Patients who failed to attend postoperative follow-up or did not complete the 6-month follow-up established in the research protocol.

from the public institution, which considerably limited the inclusion of a larger number of patients.

The following variables were analyzed: demographic characteristics (age and sex), diagnosis and type of strabismus, type of anesthesia, preoperative deviation, immediate postoperative deviation, deviation at 6 months, and intraoperative complications. Surgical success was defined as orthotropia (no deviation) or a residual deviation ≤ 10 prism diopters (PD), whereas failure was defined as a residual deviation > 10 prism diopters (PD).

The procedures were performed at specialized ophthalmic surgical centers, including the Department of Ophthalmology of Hospital de Clínicas, Faculty of Medical Sciences, National

University of Asunción, and the Centro Oftalmológico de Diagnóstico y Tratamiento S.A., Asunción, Paraguay.

The surgical technique consisted of muscle recessions, resections, advancements, and myectomies using adjustable sutures. The extraocular muscle was positioned at a predetermined distance from its original insertion, measured in millimeters, or from the corneoscleral limbus in reoperations, using 6-0 absorbable polyglycolic acid or polyglactin sutures. Once the muscle was positioned as planned, the suture was tied with a temporary knot. Ocular alignment was then evaluated with the Hirschberg test and the cover test, while the patient was awake and seated. Once the desired alignment was achieved, the suture was permanently secured.

Anesthesia consisted of 0.5% proparacaine hydrochloride topical eye drops alone or combined with 2% lidocaine administered in small doses (0.5 mL) into the sub-Tenon's space, and/or intravenous propofol sedation administered by an anesthesiologist.

Data were analyzed using SPSS version 22. Qualitative variables were summarized as frequencies and percentages, whereas quantitative variables were expressed as means and standard deviations.

Regarding ethical considerations, the study was conducted in accordance with current ethical standards and received approval from the institutional ethics committee. Informed consent from participants was not required because this was a retrospective study; however, consent was obtained for the publication of clinical photographs. Confidentiality and anonymity of all analyzed data were guaranteed in accordance with the principles of the Declaration of Helsinki.

Results

A total of 77 patients were included in the study, with a mean age of 27 years. Fifty-two percent were male. Forty-five percent underwent surgery under topical anesthesia alone using 0.5% proparacaine hydrochloride ophthalmic solution, while the remaining 55% received combined topical anesthesia with 2% sub-Tenon's lidocaine and intravenous sedation

with propofol (**Tables 2 and 3**).

The types of strabismus included 52 esotropias (ET), 20 exotropias (XT), and 5 hypertropias (HT). Regarding the clinical forms of esotropia, infantile esotropia was the most frequent diagnosis (31%). Among the exotropias, consecutive exotropia was the most common, accounting for 14% of cases. Hypertropia represented 6% of all cases (**Table 4**).

The mean preoperative deviation was 39.99 prism diopters (PD), decreasing to 1.86 PD in the immediate postoperative period and 3.78 PD at the 6-month follow-up. The immediate surgical success rate was 99%, while the success rate at 6 months was 92% (**Table 5**).

Comparisons between the preoperative deviations and the immediate and 6-month postoperative deviations are presented in **Tables 6 and 7**, respectively. It is noteworthy that although some patients continued to be classified as having esotropia after surgery, the magnitude of the deviation was substantially reduced, resulting in a surgical success rate approaching 100%.

The most frequent complication was pain during muscle traction (47%), occurring predominantly in patients who received topical anesthesia alone. No systemic vagal complications, including nausea, vomiting, bradycardia, or cardiac arrest, were observed during the surgical procedures (**Table 8**).

Table 2. Demographic Characteristics of the Patients.

Characteristics	Results
Total patients included: 77	
Institution	n (%)
Hospital de clínicas	53 (69)
Private clinic	24 (31)
Age ^a : 27,23 (±8,2)	
Sex	n (%)
Male	40 (52)
Female	37 (48)

^aMean ± Standard deviation

Table 3. Types of Anesthesia Used.

Characteristics	Results
Type of anesthesia	n (%)
Topical	35 (45)
Topical + sub-Tenon's anesthesia + propofol	42 (55)

Tabla 4. Preoperative Diagnoses and Types of Strabismus.

Diagnosis	Frequency	Percentage
ET (ESOTROPIA)		
INFANTILE ESOTROPIA	24	31,17
ADULT ACQUIRED ESOTROPIA	6	7,79
RESIDUAL ESOTROPIA	6	7,79
ESOTROPIA (LEFT VI CRANIAL NERVE PALSY)	7	9,09
PARTIALLY ACCOMMODATIVE ESOTROPIA	3	3,90
ESOTROPIA (RIGHT VI CRANIAL NERVE PALSY)	3	3,90
SECONDARY ESOTROPIA	2	2,60
CONSECUTIVE ESOTROPIA	1	1,30
XT (EXOTROPIA)		
CONSECUTIVE EXOTROPIA	11	14,29
CONSTANT EXOTROPIA	5	6,49
INTERMITTENT EXOTROPIA	2	2,60
SECONDARY EXOTROPIA	1	1,30
RESIDUAL EXOTROPIA	1	1,30
HT (HYPERTROPIA)		
LEFT HYPERTROPIA	2	2,60
RIGHT HYPERTROPIA	2	2,60
RIGHT HYPERTROPIA (RIGHT IV CRANIAL NERVE PALSY)	1	1,30

Table 5. Descriptive Statistics of Preoperative, Immediate Postoperative, and 6-Month Postoperative Deviations.

Descriptive Statistics	Preoperative Deviation	Immediate Postoperative Deviation	6-Month Postoperative Deviation
Mean	39,99	1,86	3,78
Standard deviation	17,78	3,17	5,58
Range	85,00	12,00	25,00
Minimum	10,00	0,00	0,00
Maximum	95,00	12,00	25,00
Surgical success (≤10 prism diopters)	76 (99%)	71 (92%)	

Table 6. Preoperative Type of Deviation and Immediate Postoperative Deviation.

Preoperative Deviation	Immediate Postoperative Deviation				Total
	ET	HT	ORTO	XT	
ET	12	0	37	3	52
HT	0	2	3	0	5
XT	5	0	12	3	20
Total	17	2	52	6	77

Table 7. Preoperative Type of Deviation and 6-Month Postoperative Deviation.

Preoperative Deviation	6-Month Postoperative Deviation				Total
	ET	HT	ORTO	XT	
ET	16	0	31	5	52
HT	0	3	2	0	5
XT	4	0	6	10	20
Total	20	3	39	15	77

Table 8. Intraoperative Complications Observed.

Type of Anesthesia	No Complications	Pain During Muscle Traction	Total
Topical	0	35	35
Topical + Sub-Tenon's + Propofol	41	1	42
Total	41	36	77

Discussion

Intraoperative adjustable surgery emerged as an alternative to conventional strabismus surgery, particularly for complex cases in which predicting the surgical outcome is difficult. Individual factors such as binocular fusion, amblyopia, refractive error, and neurological conditions may influence postoperative alignment ⁽¹¹⁾.

Authors such as Jampolsky, Keech, and Rosenbaum introduced the adjustable suture technique to improve the precision of ocular alignment ⁽¹²⁻¹⁴⁾. However, delayed suture adjustment has several disadvantages, including pain, edema, risk of infection, and vasovagal complications ⁽¹⁵⁻¹⁷⁾.

Topical anesthesia alone, or combined with sedation and/or sub-Tenon's anesthesia,

allows intraoperative adjustment to be performed in the operating room, thereby avoiding the limitations of delayed adjustment and reducing the risks associated with general anesthesia ⁽¹⁸⁻²⁴⁾.

The results of the present study—a 99% immediate success rate and 92% success at 6 months—are comparable to or even better than those reported internationally.

Merino and Gómez de Liaño ⁽²⁵⁾ reported a 90% immediate success rate and 85% success at six months, with a low rate of reoperations. Brugnoli de Pagano ⁽²⁶⁾ achieved a stable correction rate of 76.5%. Zhang ⁽²⁷⁾ demonstrated superior short-term outcomes with adjustable sutures. Seijas and Gómez de Liaño ⁽²⁸⁾ reported a 95% immediate success rate and an 85% long-

term success rate. Vallés-Torres ⁽²⁹⁾ found higher success rates with topical anesthesia than with general anesthesia. Ganesh ⁽³⁰⁾ demonstrated that topical anesthesia alone is feasible and well tolerated. Leffler ⁽³¹⁾ reported a lower reoperation rate with the adjustable technique. Mireskandari ⁽³²⁾ found a higher proportion of patients achieving the desired ocular alignment with adjustable surgery. Ohmi ⁽³³⁾, Koc ⁽³⁴⁾, and Park ⁽³⁵⁾ confirmed the effectiveness of topical anesthesia combined with sedation or topical anesthesia combined with sub-Tenon's anesthesia.

Our findings are consistent with the published literature, demonstrating a high immediate success rate, a slight reduction in success at intermediate follow-up, and a minimal incidence of complications.

Conclusion

Intraoperative adjustable surgery performed under topical anesthesia alone or in combination with sedation and/or sub-Tenon's anesthesia is a safe, effective, and reproducible technique for the treatment of various types of strabismus. It allows precise ocular alignment through intraoperative assessment, avoids systemic complications associated with general anesthesia, and reduces the need for reoperations.

Although this technique is not applicable to children or patients with severe neurological or psychiatric disorders, it offers significant advantages in cooperative adults, including lower anesthetic risk, rapid recovery, low cost, and the possibility of evaluating extraocular muscle function in real time.

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Bibliographic References

1. Helveston EM. Historia del estrabismo. Estrabismos: atlas de cirugía. 3a ed. Buenos Aires: Editorial Médica Panamericana; 1986. p. 15-6.
2. Boyd K. ¿Qué es el estrabismo del adulto? San Francisco (CA): American Academy of Ophthalmology; 2024. Disponible en: <https://www.aao.org/salud-ocular/enfermedades/estrabismo>
3. Roberts CJ, Gómez de Liaño R. El estrabismo en adultos. Superficie Ocular. 2007;2007(35):3-34. Disponible en: https://www.laboratorioshea.com/medias/thea_superficie_ocular_35.pdf
4. Dell R, Williams B. Anaesthesia for strabismus surgery: a regional survey. Br J Anaesth. 1999;82(5):761-3. doi: 10.1093/bja/82.5.761.
5. Vidal Vademecum Spain. Propofol. Madrid: Vidal Vademecum Spain; s. f. Disponible en: <https://www.vademecum.es/principios-activos-propofol-n01ax10>
6. Snir M, Bachar M, Katz J, Friling R, Weinberger D, Axer-Siegel R. Combined propofol sedation with sub-Tenon's lidocaine/mercaine infusion for strabismus surgery in adults. Eye (Lond). 2007;21(9):1155-61. doi: 10.1038/sj.eye.6702426.
7. Zimmermann-Paiz MA, Córdón-Pineda KB, Fang-Sung JW. Sutura ajustable en estrabismo. Rev Mex Oftalmol. 2008;82(3):158-62.
8. Castillo Pérez AC, Naranjo Fernández RM, Méndez Sánchez TJ, Pérez Parra Z. Suturas ajustables como alternativa quirúrgica en la corrección del estrabismo. Rev Cubana Oftalmol. 2008;21(1). Disponible en: https://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-21762008000100003
9. Buffenn AN. Adjustable suture use in strabismus surgery. Curr Opin Ophthalmol. 2005;16(5):294-7. doi: 10.1097/01.icu.0000180918.71932.b3.
10. Etimologías de Chile. Estrabismo. 2017. Disponible en: <https://etimologias.dechile.net/?estrabismo>
11. Prieto-Díaz J, Souza-Dias C. Estrabismo. 2a ed. Barcelona: Editorial JIMS; 1986.
12. Jampolsky A. Current techniques of adjustable strabismus surgery. Am J Ophthalmol. 1979;88(3):406-418. doi: 10.1016/0002-9394(79)90641-X.
13. Keech RV, Scott WE, Christensen LE. Adjustable suture strabismus surgery. J Pediatr Ophthalmol Strabismus. 1987;24(2):97-102. doi: 10.3928/0191-3913-19870301-11.
14. Rosenbaum AL, Metz HS, Carlson M, Jampolsky A. Adjustable rectus muscle recession surgery: a follow-up study. Arch Ophthalmol. 1977;95(5):817-20. doi: 10.1001/archophth.1977.04450050095010.
15. Prieto-Díaz J, Souza-Dias C. Strabismus. 4th ed. Woburn (MA): Butterworth-Heinemann; 1999.

16. Wright KW, editor. Pediatric ophthalmology and strabismus. St. Louis (MO): Mosby; 1995.
17. Boyd K. Estrabismo infantil. San Francisco (CA): American Academy of Ophthalmology; 2025. Disponible en: <https://www.aao.org/salud-ocular/enfermedades/estrabismo-infantil>
18. Vallés-Torres J, García-Martín E, Peña-Calvo P, Sanjuan-Villarreal A, Gil-Arribas L, Fernández-Tirado FJ. Contact topical anesthesia for strabismus surgery in adult patients. Rev Esp Anestesiol Reanim. 2015;62(5):265-9. doi: 10.1016/j.redar.2014.07.005.
19. Tatham A, Amaya L. Immediate post-operative adjustable suture strabismus surgery using a target-controlled infusion of propofol-remifentanyl. Ophthalmologica. 2009;223(3): 192 - 195. doi: 10.1159/000200766.
20. Yu CBO, Wong VWY, Fan DSP, Yip WWK, Lam DSC. Comparison of lidocaine 2% gel versus amethocaine as the sole anesthetic agent for strabismus surgery. Ophthalmology. 2003;110(7):1426-9. doi: 10.1016/S0161-6420(03)00453-6.
21. Steele MA, Lavrich JB, Nelson LB, Koller HP. Sub-Tenon's infusion of local anesthetic for strabismus surgery. Ophthalmic Surg. 1992;23(1):40-3. doi: 10.3928/1542-8877-19920101-11.
22. Naranjo Fernández RM, Pons Castro L, Pedroso Llanes A, Padilla González CM. Anestesia subtenoniana en cirugía de estrabismo. Rev Cubana Oftalmol. 2004;17(2). Disponible en: https://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-21762004000200005
23. Kim S, Yang Y, Kim J. Tolerance of patients and postoperative results: topical anesthesia for strabismus surgery. J Pediatr Ophthalmol Strabismus. 2000;37(6):344-8. doi: 10.3928/0191-3913-20001101-08.
24. Corrêa BAS, Bicas HEA. Estudo comparativo de cirurgias monoculares para esotropias sob anestesia geral e sob anestesia tópica, com ou sem reajuste. Rev Bras Oftalmol. 1998;57(10):747-55.
25. Merino Sanz P, Gómez de Liaño Sánchez P, Patchkoria K. Anestesia tópica en la cirugía de estrabismo. Salud(i) Ciencia. 2015;21(7):723-8.
26. Brugnoli de Pagano O, Ortiz V, Rosáenz G, Molina ML. Suturas ajustables: mejor opción en cirugía de estrabismo en adultos. Arch Chil Oftalmol. 2005;63(2):221-6.
27. Zhang MS, Hutchinson AK, Drack AV, Cleveland J, Lambert SR. Improved ocular alignment with adjustable sutures in adults undergoing strabismus surgery. Ophthalmology. 2012;119(2):396-402. doi: 10.1016/j.ophtha.2011.07.044.
28. Seijas O, Gómez de Liaño P, Merino P, Roberts CJ, Gómez de Liaño R. Topical Anesthesia in Strabismus Surgery: a Review of 101 Cases. Journal of Pediatric Ophthalmology & Strabismus. 2009; 46(4): p. 218-222.
29. Vallés-Torres J, García-Martín E, Fernández-Tirado FJ, Gil-Arribas LM, Pablo LE, Peña-Calvo P. Anestesia tópica de contacto versus anestesia general en cirugía de estrabismo. Archivos de la Sociedad Española de Oftalmología. 2016; 91(3):108-113. doi: 10.1016/j.of-tal.2015.11.012.
30. Ganesh SC, Rao SG, Narendran K. Evaluation of single-stage adjustable strabismus surgery (SSASS) under topical anesthesia in patients with symptomatic diplopia. Strabismus. 2020;28(4):215-22. doi: 10.1080/09273972.2020.1832545.
31. Leffler CT, Vaziri K, Cavuoto KM, McKeown CA, Schwartz SG, Kishor KS, et al. Strabismus surgery reoperation rates with adjustable and conventional sutures. Am J Ophthalmol. 2015;160(2):385-90.e4. doi: 10.1016/j.ajo.2015.05.014.
32. Mireskandari K, Cotesta M, Schofield J, Kraft SP. Utility of adjustable sutures in primary strabismus surgery and reoperations. Ophthalmology. 2012;119(3):629-33. doi: 10.1016/j.ophtha.2011.08.025.
33. Ohmi G, Hosohata J, Okada AA, Fujikado T, Tanahashi N, Uchida I. Strabismus surgery using the intraoperative adjustable suture method under anesthesia with propofol. Jpn J Ophthalmol. 1999;43(6):522-5. doi: 10.1016/S0021-5155(99)00114-8.
34. Koc F, Durlu N, Ozal H, Yasar H, Firat E. Single-stage adjustable strabismus surgery under topical anesthesia and propofol. Strabismus. 2005;13(4):157-61. doi: 10.1080/09273970500449439.
35. Park JM, Lee SJ, Choi HY. Intraoperative adjustable suture strabismus surgery under topical and subconjunctival anesthesia. Ophthalmic Surg Lasers Imaging. 2008;39(5):373-8. doi: 10.3928/15428877-20080901-13.