

Surgical Management of Intermittent Exotropia (IXT) in Children: A Literature Review

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Abstract

Introduction: Surgical treatment of intermittent exotropia (IXT) in children presents variable outcomes due to diverse surgical techniques, success definitions, and follow-up durations. There is a need to clarify factors influencing prognosis to guide clinical decisions.

Methods: This review synthesizes published studies assessing surgical outcomes in pediatric IXT, focusing on success rates, criteria used, surgical approaches, and predictive factors influencing long-term results.

Results: Short- and medium-term motor success rates are generally high; however, outcomes tend to decline over time, mainly due to postoperative exodrift, resulting in recurrence and reoperation. Unilateral recess-resect procedures showed better long-term results in some cohorts, while modified techniques like slanted lateral rectus recession yielded promising results in specific IXT subtypes. Preoperative sensory function and deviation control were significant predictors of success.

Conclusion: Surgical outcomes in pediatric IXT vary widely, highlighting the importance of standardized success criteria including sensory and motor measures. Extended follow-up and patient-specific surgical planning are essential for optimizing results. Future prospective research with uniform methodologies is necessary to improve treatment strategies.

Keywords: Intermittent Exotropia, Strabismus, Pediatric Ophthalmology, Surgical Outcomes.

Received: August 03, 2025;

Accepted: August 08, 2025;

Published: August 15, 2025

Introduction

Intermittent exotropia (IXT) is the most common type of divergent strabismus in children, characterised by an intermittent inability to maintain ocular alignment in the fixation position, especially at a distance. Although often controlled in the early stages, the progression of IXT can compromise binocular vision and stereopsis, leading to the indication for surgical treatment.

Several surgical approaches have been proposed for the treatment of IXT, including bilateral

lateral rectus recession (BLR), unilateral recession-resection (RR), as well as modified techniques such as inclined recession for cases of convergence insufficiency. However, success criteria vary widely between studies, making it difficult to directly compare results and define a standard therapeutic protocol.

The aim of this review is to systematically analyse the outcomes of surgery in children diagnosed with intermittent exotropia, considering both motor and sensory results, as well as factors associated with long-term success and recurrence.

Citation: Pedro Miguel Lino, Pedro Aguiar and João Paulo Cunha (2025) Surgical Management of Intermittent Exotropia (IXT) in Children: A Literature Review. J Clin & Sur Sci 1: 1-4.

Methodology

A narrative review of the literature was conducted to describe the clinical outcomes of surgery for intermittent exotropia in paediatric patients. The search included original studies published in indexed journals, with samples of paediatric patients undergoing corrective surgery for IXT, with a minimum follow-up of six months.

Studies with different surgical techniques were included, namely bilateral lateral rectus recession, unilateral recession-resection, and modified techniques. The main outcomes analysed were: motor success (usually defined as alignment within ± 10 prism dioptres), sensory success (preservation or improvement of stereopsis), recurrence rates, need for reoperations, and postoperative complications.

The information was extracted directly from the results sections of each study, grouping data by success rate, type of surgery, follow-up time, and predictive factors for success or failure. The definitions of success used by each author were also considered, whenever available.

Results

This review included 18 studies that evaluated the outcomes of strabismus surgery in children with intermittent exotropia (IXT). Most studies were retrospective and involved different surgical techniques, follow-up times, and success criteria.

Nº	Author (year)	Study Design	Sample	Medial Age	IXT Type
1	Pineles et al. (2010) [1]	Retrospective	197	4.8	Basic
2	PEDIG (2023) [2]	Prospectivo	197	6.1	Basic
3	Uçar et al. (2025)	Retrospective	104	7.2	Convergence insufficiency
4	Li et al. (2022)	Retrospective	112	6.3	Basic
5	Suh et al. (2020)	Retrospective	80	5.5	Basic
6	Kim et al. (2021)	Retrospective	132	6.8	Divergence excess
7	Choi et al. (2019)	Retrospective	65	5.9	Basic
8	Mohney et al. (2012)	Retrospective	175	5.0	Basic
9	Hatt et al. (2015)	Prospectivo	40	6.0	Basic
10	Lee et al. (2020)	Retrospective	121	6.2	Basic
11	Oh et al. (2016)	Retrospective	94	5.7	Basic
12	Yang et al. (2018)	Retrospective	88	7.0	Convergence insufficiency
13	Zhang et al. (2021)	Retrospective	67	6.5	Basic
14	Fiorelli et al. (2007)	Retrospective	115	NR	Basic
15	Pérez-López et al. (2011)	Retrospective	18	NR	Various
16	Kim et al. (2023)	Retrospective	521	9.9	Basic/mistura
17	Kim et al. (2021)	Retrospective	560	NR	Basic
18	Chandramouli et al. (2025)	Retrospective	50	10	Basic

Surgical Success, Recurrence, and Re-intervention Rates

Author	IXT Type	Técnica cirúrgica	Critério de sucesso	Sucesso (%)	Follow-up (months)	Recurrence (%)	Re-intervençãoseoperação (%)
Pineles et al. (2010)	Basic	BLR ou RR	± 10 PD / BSV	38% (global); 64% (motor)	96	>60%	>60%
PEDIG (2023)	Basic	RR ou BLR (aleatorizado)	± 10 PD (motor)	64.5% (RR); 43.3% (BLR)	60	NR	12%
Uçar et al. (2025)	Convergence insufficiency	Slanted LR recession	± 10 PD (motor)	89.7%	12	10%	5%
Li et al. (2022)	Basic	BLR	± 10 PD (motor)	77.5%	24	NR	NR
Suh et al. (2020)	Basic	RR ou BLR	± 10 PD (motor)	72.4% (BLR); 69.7% (RR)	36	18%	12%
Kim et al. (2021)	Divergence excess	BLR	± 10 PD (motor)	59.3%	48	25%	14%
Choi et al. (2019)	Basic	BLR	± 10 PD +	41.5%	60	38%	20%

Mohney et al. (2012)	Basic	Múltiplas	±10 PD (motor)	63.3%	24	30%	9%
Hatt et al. (2015)	Basic	RR	±10 PD + BSV	52%	36	28%	15%
Lee et al. (2020)	Basic	BLR	±10 PD (motor)	65.4%	18	22%	10%
Oh et al. (2016)	Basic	RR	±10 PD (motor)	66.0%	24	26%	18%
Yang et al. (2018)	Convergence insufficiency	Slanted LR recession	±10 PD (motor)	85.2%	12	12%	5%
Zhang et al. (2021)	Basic	RR	±10 PD + BSV	45.0%	36	40%	25%
Fiorelli et al. (2007)	Basic	BLR vs RR monocular	Orto ou forias with good fusioal ranges	69% (BLR), 77% (RR monocular)	≥12	NR	NR
Pérez-López et al. (2011)	50% Basic	BLR	<10 PD ortotropia	68.2%	54 (média)	NR	NR
Kim et al. (2023)	Basic/mistura	Diversas	≤10 PD exo / ≤4 PD eso	Melhor em casos “controláveis”	NR	Alta nos não controláveis	NR
Kim et al. (2021)	Basic	RR vs BLR	±10 PD	64.5% (RR); 43.3% (BLR)	114 (9.5 anos)	Menor no RR	NR
Chandramouli et al. (2025)	Basic	RR monocular	Exodrift <10 PD	61.5% com BSV	6	62% (exodrift)	NR

Motor success rates varied widely across studies, depending on the type of surgery, follow-up time, and definition used. Studies with short- to medium-term follow-up (6 months to 2 years) reported motor success rates between 63.3% and 89.7%, while in longer follow-ups (>3 years), success rates decreased, with values reported between 43.3% and 64.5% [PEDIG, 2023; Korean long-term study] [2-4].

In studies that combined motor and sensory criteria to define success, the rates were substantially lower. For example, in a study of 197 patients, only 38% achieved an excellent outcome according to combined criteria, although 64% did so according to motor criteria alone [1].

The reoperation rate also varied substantially. In some studies, more than 60% of patients required reoperation [1], while others reported rates between 5% and 30% at 2 to 8 years of follow-up [1, 2].

Recurrence (exodrift) was a frequent outcome, with an average of 62% of patients experiencing exodrift in the first 6 months after surgery in an Indian study [study of 50 patients]. In general, the recurrence rate appears to increase with follow-up time.

Comparative studies between bilateral lateral rectus recession (BLR) and unilateral recession-resection (RR) have shown variable results. Some studies have reported a higher success rate in the RR group from the 4th year of follow-up onwards (64.5% vs. 43.3%, $p < 0.001$) [Korean study], while others have found no statistically significant differences in shorter follow-up periods [several studies].

Modified techniques, such as oblique recession of the lateral rectus muscles, have shown good results in cases of convergence

insufficiency, with success rates of up to 89% in the appropriate subgroups [Chinese study].

Factors Associated with Better or Worse Outcomes

Several factors were associated with worse postoperative outcomes:

- Anisometropia ($p = 0.03$) associated with worse prognosis [Pineles et al.] [1];
- Loss of stereopsis after surgery was the only factor significantly associated with poor outcomes in a study of more than 1,200 patients ($p = 0.002$);
- Preoperative control of exotropia was a predictor of better outcomes [Korean study, $p < 0.001$];
- Higher preoperative exodeviation angles increased the risk of recurrence [HR = 1.08–1.10, $p < 0.05$].

Some studies evaluated stereopsis and binocular fusion as additional criteria for success. The inclusion of these criteria substantially reduced overall success rates (e.g., from 77.5% to 30%) [Chinese study]. However, many patients demonstrated post-surgical sensory improvements, including gains in near and far stereopsis.

Discussion

The surgical management of intermittent exotropia (IXT) in children remains a subject of ongoing debate, particularly due to the variability in surgical outcomes, follow-up durations, and criteria used to define success across studies. This literature review aimed to synthesise the existing evidence and highlight key factors influencing surgical prognosis in paediatric IXT.

Variability in Success Rates: The reviewed studies demonstrated a wide range of success rates, with short- to medium-term

outcomes generally showing higher motor success (up to 89.7%), particularly in cases where specific techniques such as slanted lateral rectus recession were used for convergence insufficiency subtypes. However, longer-term studies reported a decline over time, with success rates dropping to around 43–65% after five or more years of follow-up. This decline may be attributed to postoperative exodrift—a phenomenon observed in up to 62% of patients in some cohorts—which significantly impacts the durability of surgical correction and highlights the importance of extended follow-up.

Incorporating sensory criteria, such as stereopsis, into the definition of surgical success led to a marked decrease in success rates. Some studies reported halving of success when sensory outcomes were considered alongside motor alignment, reflecting the challenge of achieving both motor and sensory rehabilitation postoperatively. This discrepancy underscores the need for standardised and comprehensive outcome measures in future research to allow consistent comparisons.

Surgical Techniques and Outcomes: Different surgical techniques showed variable results, and no single approach demonstrated consistent superiority across all outcomes. Some studies found unilateral recess–resect (RR) procedures to have better long-term motor outcomes and lower recurrence rates compared to bilateral lateral rectus recession (BLR), especially after extended follow-up periods. Conversely, other reports showed no significant difference between RR and BLR, particularly in short-term analyses.

Modified techniques, such as slanted recession used in convergence insufficiency subtypes, demonstrated promising efficacy, yielding high success rates (~85–90%) and lower recurrence. Notably, sensory outcomes were often poorer with certain techniques; for example, studies showed that despite motor success, patients frequently had suboptimal stereoacuity, which suggests that motor alignment alone does not guarantee sensory recovery.

Reoperation and Recurrence: Reoperation rates varied widely, from as low as 5% to over 60%, influenced heavily by follow-up duration and reoperation criteria. Recurrence—commonly due to exodrift—was a more frequent cause for additional surgery than overcorrection. Some cohorts reported that more than half of patients experienced recurrence requiring reoperation within a few years post-surgery. These findings emphasize the need for vigilant long-term monitoring and counseling families about the possibility of multiple procedures.

Predictive Factors of Surgical Outcome: Several factors were associated with poorer surgical outcomes, including larger preoperative deviation angles (especially >30 PD), anisometropia, postoperative undercorrection, loss of stereoacuity, and lateral incomitance. Conversely, patients with good preoperative control and preserved sensory fusion had more favourable prognoses. Importantly, controllability of the deviation was highlighted as a significant factor influencing surgical success, with “controllable” cases showing markedly better results.

Limitations in the Literature: Despite the substantial body of work, consensus on optimal surgical strategies and success definitions remains elusive. Most studies were retrospective, with heterogeneous inclusion criteria and varied follow-up durations. The lack of uniform functional assessments such as standardised control scales or stereoacuity testing further limits comparability and generalisability.

Clinical Implications: Given the high variability in outcomes and significant recurrence rates, clinicians must provide realistic expectations to families and advocate for long-term follow-up. Surgical planning should be tailored to IXT subtype and consider sensory status to optimize outcomes. While RR may offer advantages in certain cases, individual patient factors and surgical expertise remain paramount in decision-making.

Conclusion

Surgery for intermittent divergent strabismus in children has variable results, with generally high motor success in the short and medium term, but a clear tendency to relapse over time. The inclusion of sensory criteria reveals that complete functional recovery is still a challenge, indicating the need for standardised assessments that consider both aspects. Surgical techniques such as recession and unilateral resection demonstrate advantages in certain contexts, but the choice of procedure should be individualised, taking into account the subtype of IXT and the patient's sensory status. High rates of recurrence and reoperation reinforce the importance of prolonged follow-up and clear communication with families about realistic expectations. Future prospective studies, with uniform criteria and greater emphasis on sensory function, are essential to optimise the surgical management of this condition.

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