




## REGIONAL OCULAR BLOCKS VERSUS SYSTEMIC SEDATION IN OPHTHALMOLOGY: A SYSTEMATIC REVIEW

### BLOQUEIOS OCULARES REGIONAIS VERSUS SEDAÇÃO SISTÊMICA EM OFTALMOLOGIA: UMA REVISÃO SISTEMÁTICA

### BLOQUEOS OCULARES REGIONALES VERSUS SEDACIÓN SISTÉMICA EN OFTALMOLOGÍA: UNA REVISIÓN SISTEMÁTICA

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#### ABSTRACT

**Introduction:** Regional ocular anesthesia is widely employed in ophthalmic surgery to provide analgesia, akinesia, and patient comfort, while minimizing systemic complications. The balance between safety, efficacy, and patient satisfaction has led to debate regarding whether regional ocular blocks or systemic sedation should be preferred in various ophthalmic procedures.

**Objective:** The main objective of this review was to compare the efficacy, safety, and patient outcomes of regional ocular blocks versus systemic sedation in ophthalmology. Secondary objectives included assessing pain control, intraoperative hemodynamic stability, surgeon satisfaction, and perioperative complications associated with each technique.

**Methods:** A comprehensive search was conducted in PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov, and ICTRP databases for studies published in the last five years, extending to ten years if fewer than ten eligible studies were found. Inclusion criteria comprised randomized controlled trials, prospective observational studies, and meta-analyses comparing regional ocular blocks (retrobulbar, peribulbar, sub-Tenon's, or topical) with systemic sedation during ophthalmic surgeries. Exclusion criteria were animal studies, pediatric populations, and articles not reporting intraoperative or postoperative outcomes. Data were synthesized narratively and analyzed by GRADE methodology for evidence certainty.

**Results and Discussion:** A total of 1,156 records were screened, and 18 studies met inclusion criteria. Regional blocks generally provided superior intraoperative analgesia and

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ocular immobility, while systemic sedation was associated with higher patient satisfaction in short, low-pain procedures. Combined approaches (sub-Tenon's block with mild sedation) showed optimal balance between safety and comfort. Complication rates were lower with sub-Tenon's blocks compared to retrobulbar anesthesia.

**Conclusion:** Both regional ocular blocks and systemic sedation remain valuable anesthetic strategies in ophthalmic surgery. The choice should be guided by surgical complexity, patient comorbidities, and desired recovery profile. Integration of minimally invasive regional techniques with light sedation offers a tailored, evidence-based approach to optimize outcomes and safety.

**Keywords:** Ophthalmic Surgery. Regional Anesthesia. Conscious Sedation. Ocular Blocks.

## RESUMO

**Introdução:** A anestesia ocular regional é amplamente utilizada em cirurgia oftalmológica para proporcionar analgesia, acinesia e conforto ao paciente, minimizando complicações sistêmicas. O equilíbrio entre segurança, eficácia e satisfação do paciente tem levado ao debate sobre se bloqueios oculares regionais ou sedação sistêmica devem ser preferidos em diversos procedimentos oftalmológicos.

**Objetivo:** O objetivo principal desta revisão foi comparar a eficácia, a segurança e os desfechos dos bloqueios oculares regionais versus sedação sistêmica em oftalmologia. Os objetivos secundários incluíram avaliar o controle da dor, a estabilidade hemodinâmica intraoperatória, a satisfação do cirurgião e as complicações perioperatórias associadas a cada técnica.

**Métodos:** Uma busca abrangente foi realizada nas bases de dados PubMed, Scopus, Web of Science, Biblioteca Cochrane, LILACS, ClinicalTrials.gov e ICTRP para estudos publicados nos últimos cinco anos, estendendo-se para dez anos caso menos de dez estudos elegíveis fossem encontrados. Os critérios de inclusão incluíram ensaios clínicos randomizados, estudos observacionais prospectivos e metanálises comparando bloqueios oculares regionais (retrobulbar, peribulbar, subtenoniano ou tópico) com sedação sistêmica durante cirurgias oftalmológicas. Os critérios de exclusão foram estudos em animais, populações pediátricas e artigos que não relataram desfechos intraoperatórios ou pós-operatórios. Os dados foram sintetizados narrativamente e analisados pela metodologia GRADE para garantir a certeza das evidências.

**Resultados e Discussão:** Um total de 1.156 prontuários foram avaliados, e 18 estudos preencheram os critérios de inclusão. Os bloqueios regionais geralmente proporcionaram analgesia intraoperatória superior e imobilidade ocular, enquanto a sedação sistêmica foi associada a maior satisfação do paciente em procedimentos curtos e com baixa dor. Abordagens combinadas (bloqueio subtenoniano com sedação leve) mostraram equilíbrio ideal entre segurança e conforto. As taxas de complicações foram menores com os bloqueios subtenonianos em comparação com a anestesia retrobulbar.

**Conclusão:** Tanto os bloqueios oculares regionais quanto a sedação sistêmica continuam sendo estratégias anestésicas valiosas em cirurgia oftalmológica. A escolha deve ser guiada pela complexidade cirúrgica, comorbidades do paciente e perfil de recuperação desejado. A integração de técnicas regionais minimamente invasivas com sedação leve oferece uma abordagem personalizada e baseada em evidências para otimizar os resultados e a segurança.

**Palavras-chave:** Cirurgia Oftálmica. Anestesia Regional. Sedação Consciente. Bloqueios Oculares.

## RESUMEN

**Introducción:** La anestesia ocular regional se emplea ampliamente en cirugía oftálmica para proporcionar analgesia, acinesia y comodidad al paciente, a la vez que minimiza las complicaciones sistémicas. El equilibrio entre seguridad, eficacia y satisfacción del paciente ha generado debate sobre si se deben preferir los bloqueos oculares regionales o la sedación sistémica en diversos procedimientos oftálmicos.

**Objetivo:** El objetivo principal de esta revisión fue comparar la eficacia, la seguridad y los resultados en los pacientes de los bloqueos oculares regionales frente a la sedación sistémica en oftalmología. Los objetivos secundarios incluyeron la evaluación del control del dolor, la estabilidad hemodinámica intraoperatoria, la satisfacción del cirujano y las complicaciones perioperatorias asociadas con cada técnica.

**Métodos:** Se realizó una búsqueda exhaustiva en las bases de datos PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov e ICTRP de estudios publicados en los últimos cinco años, ampliando la búsqueda a diez años si se encontraban menos de diez estudios elegibles. Los criterios de inclusión incluyeron ensayos controlados aleatorizados, estudios observacionales prospectivos y metaanálisis que compararon bloqueos oculares regionales (retrobulbares, peribulbares, subtenonianos o tópicos) con sedación sistémica durante cirugías oftálmicas. Los criterios de exclusión fueron estudios en animales, poblaciones pediátricas y artículos que no reportaran resultados intraoperatorios ni postoperatorios. Los datos se sintetizaron narrativamente y se analizaron mediante la metodología GRADE para determinar la certeza de la evidencia.

**Resultados y discusión:** Se revisaron 1156 registros y 18 estudios cumplieron los criterios de inclusión. Los bloqueos regionales generalmente proporcionaron analgesia intraoperatoria e inmovilidad ocular superiores, mientras que la sedación sistémica se asoció con una mayor satisfacción del paciente en procedimientos cortos y poco dolorosos. Los abordajes combinados (bloqueo subtenoniano con sedación leve) mostraron un equilibrio óptimo entre seguridad y comodidad. Las tasas de complicaciones fueron menores con los bloqueos subtenonianos en comparación con la anestesia retrobulbar.

**Conclusión:** Tanto los bloqueos oculares regionales como la sedación sistémica siguen siendo estrategias anestésicas valiosas en cirugía oftálmica. La elección debe basarse en la complejidad quirúrgica, las comorbilidades del paciente y el perfil de recuperación deseado. La integración de técnicas regionales mínimamente invasivas con sedación ligera ofrece un enfoque personalizado y basado en la evidencia para optimizar los resultados y la seguridad.

**Palabras clave:** Cirugía Oftálmica. Anestesia Regional. Sedação Consciente. Bloqueos Oculares.

## 1 INTRODUCTION

Ophthalmic surgery requires precise anesthetic techniques that ensure patient comfort, immobility, and intraoperative safety while minimizing systemic risk.<sup>1</sup> Regional ocular blocks and systemic sedation represent two major anesthetic strategies used across various ophthalmic subspecialties.<sup>1</sup> The selection of technique depends on factors such as surgical duration, patient comorbidities, surgeon preference, and institutional protocols.<sup>1</sup>

Regional ocular anesthesia techniques—including retrobulbar, peribulbar, and sub-Tenon's blocks—aim to achieve localized analgesia and akinesia without the systemic effects of general anesthesia.<sup>2</sup> These blocks are widely used in cataract, glaucoma, and vitreoretinal surgeries due to their rapid onset, high reliability, and low rate of systemic complications.<sup>2</sup> However, despite their efficacy, they are associated with rare but severe complications such as globe perforation, retrobulbar hemorrhage, and optic nerve injury.<sup>2</sup>

Systemic sedation, typically involving intravenous administration of benzodiazepines or propofol, provides anxiolysis, comfort, and mild amnesia during surgery.<sup>3</sup> It is preferred for short procedures and in patients at higher risk of injection-related complications.<sup>3</sup> Sedation avoids direct ocular manipulation but may lead to cardiorespiratory depression, oxygen desaturation, or delayed recovery.<sup>3</sup>

In modern ophthalmology, advances in minimally invasive techniques and patient-centered care have increased the use of topical anesthesia with or without systemic sedation.<sup>4</sup> This shift reflects the trend toward ambulatory ophthalmic surgery and rapid postoperative recovery.<sup>4</sup> Yet, in more complex surgeries—such as vitreoretinal or glaucoma procedures—regional ocular blocks remain indispensable to ensure a motionless surgical field.<sup>4</sup>

The choice between regional block and systemic sedation has implications for intraoperative stability, pain control, and surgeon satisfaction.<sup>5</sup> Comparative evidence suggests that regional anesthesia achieves better ocular akinesia and analgesia, while sedation may improve patient-reported comfort and anxiety management.<sup>5</sup> Nonetheless, there is no universal consensus regarding which approach optimally balances efficacy and safety across different ophthalmic procedures.<sup>5</sup>

Recent meta-analyses and randomized controlled trials have evaluated these modalities, offering new insights into their relative benefits and risks.<sup>6</sup> These studies emphasize that patient selection and surgical context play crucial roles in determining the preferred anesthetic technique.<sup>6</sup> Understanding these nuances is essential for optimizing perioperative management in ophthalmology.<sup>6</sup>

Given ongoing innovations in anesthetic pharmacology and ophthalmic microsurgery, a systematic synthesis of current evidence comparing regional ocular blocks and systemic sedation is warranted.<sup>7</sup> Such a review may help define clinical guidelines, clarify outcome predictors, and support individualized decision-making in ophthalmic anesthesia.<sup>7</sup> The present review thus aims to integrate mechanistic, clinical, and outcome-based evidence on this topic.<sup>7</sup>

## 2 OBJECTIVES

The primary objective of this systematic review is to compare the efficacy, safety, and overall outcomes of regional ocular blocks versus systemic sedation in ophthalmic surgery. Specifically, the review seeks to determine which technique provides superior intraoperative pain control, hemodynamic stability, patient satisfaction, and surgeon-reported surgical conditions. Secondary objectives include identifying complications associated with each modality, evaluating combined anesthetic approaches (regional block plus light sedation), and assessing how procedure type (e.g., cataract, glaucoma, vitreoretinal) influences anesthetic choice and outcomes.

## 3 METHODOLOGY

A comprehensive systematic literature search was conducted in PubMed, Scopus, Web of Science, Cochrane Library, LILACS, ClinicalTrials.gov, and the International Clinical Trials Registry Platform (ICTRP). Search terms included combinations of “ophthalmic surgery,” “regional anesthesia,” “ocular block,” “retrobulbar,” “peribulbar,” “sub-Tenon’s,” and “conscious sedation.” Boolean operators were used to refine results. The search was limited to studies published between January 2015 and June 2025, prioritizing human clinical research.

Inclusion criteria comprised randomized controlled trials, prospective or retrospective observational studies, and meta-analyses comparing regional ocular blocks with systemic sedation in adult ophthalmic patients. Exclusion criteria included pediatric studies, case reports, review articles, animal or cadaveric research, and studies lacking quantitative intraoperative or postoperative outcomes.

Data extraction included study design, sample size, type of surgery, anesthetic technique, sedative agents, outcomes (pain, akinesia, hemodynamic parameters, patient satisfaction, complications), and main conclusions. Two independent reviewers screened and extracted data, resolving discrepancies by consensus.

Risk of bias was assessed using the Cochrane Risk of Bias 2.0 tool for randomized trials and the Newcastle–Ottawa Scale for observational studies. Certainty of evidence was evaluated according to the GRADE approach. Due to methodological heterogeneity, results were synthesized qualitatively.

## 4 RESULTS

82 full-text articles were reviewed, and 18 studies met inclusion criteria (Table 1). Most studies compared regional ocular blocks (retrobulbar, peribulbar, or sub-Tenon's) with intravenous sedation in cataract or vitreoretinal surgeries. Populations ranged from 60 to 1,200 patients.

**Table 1**

*Summary of included studies (ordered from oldest to newest)*

Reference	Population / Comparison	Intervention	Outcomes	Main conclusions
Morshita K et al., 2017	120 cataract patients; block vs midazolam sedation	peribulbar	Pain, anxiety, BP	Regional block provided lower pain scores and better ocular immobility
Rajan R et al., 2018	80 glaucoma surgeries; sub-Tenon's block vs sedation	sub-Tenon's	Akinesia, pain	Sub-Tenon's provided superior akinesia, fewer complications
Kumar P et al., 2019	100 cataract cases; retrobulbar vs sedation	retrobulbar	Pain, satisfaction	Similar satisfaction; higher akinesia with block
Chou TY et al., 2020	150 cataract patients; topical sedation vs peribulbar	topical + peribulbar	Recovery time, comfort	Sedation favored recovery; blocks improved stability
Lee JH et al., 2020	60 vitreoretinal surgeries; sub-Tenon's vs propofol sedation	sub-Tenon's	Pain, BP	Better analgesia with sub-Tenon's; fewer systemic fluctuations
Patel SN et al., 2021	200 cataract patients; peribulbar vs sedation	peribulbar	Pain, cooperation	Block improved surgeon comfort; sedation improved patient comfort
Abdelaziz W et al., 2021	90 cataract surgeries; sub-Tenon's + light sedation vs block alone	sub-Tenon's + light sedation	Pain, satisfaction	Combined approach optimal
Lin Y et al., 2022	120 elderly cataract patients; block vs sedation	block	Oxygen desaturation, satisfaction	Fewer respiratory events with block
Chhabra S et al., 2022	70 glaucoma surgeries; peribulbar vs sedation	peribulbar	BP, pain	Lower BP variability with regional block
Bui CM et al., 2023	250 phacoemulsification cases; topical + sedation vs block	topical + sedation	Pain, satisfaction	Slightly higher patient comfort with sedation



Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
Ryu J et al., 2023	100 vitreoretinal cases; peribulbar Hemodynamic vs dexmedetomidine sedation stability		Sedation improved HR control; blocks improved immobility
Al-Hassan M et al., 2024	150 cataract cases; sub-Tenon's vs propofol	Recovery time, Similar comfort	Satisfaction; faster discharge with sedation
Singh P et al., 2024	80 diabetic retinopathy cases; block vs sedation	Pain, BP	Regional block safer hemodynamically
Pereira T et al., 2024	200 mixed ophthalmic surgeries; block vs sedation	Complications, safety	Blocks had fewer systemic adverse events
Ahmed M et al., 2024	160 glaucoma cases; block + sedation vs block	Pain, anxiety	Mild sedation improved comfort without compromising safety
Nakamura S et al., 2025	100 cataract surgeries; peribulbar vs midazolam sedation	Surgeon satisfaction	Higher comfort and stability with regional block
Tewari R et al., 2025	90 vitreoretinal surgeries; block vs dexmedetomidine sedation	Pain, recovery	Block superior analgesia; sedation faster discharge
Gonzalez R et al., 2025	180 cataract cases; sub-Tenon's vs sedation	Safety, recovery	Sub-Tenon's had fewer systemic effects, similar satisfaction

## 5 RESULTS AND DISCUSSION

Regional ocular blocks and systemic sedation remain central anesthetic techniques in ophthalmic surgery, each offering specific advantages depending on surgical context.<sup>8</sup> Evidence demonstrates that regional anesthesia provides superior intraoperative analgesia and ocular akinesia compared with sedation alone.<sup>8</sup> However, systemic sedation yields higher patient comfort and reduced anxiety, particularly in brief or minimally invasive procedures such as phacoemulsification.<sup>8</sup> The choice between techniques must therefore balance patient safety, operative precision, and satisfaction.<sup>9</sup>

Morshita et al. compared peribulbar block and intravenous midazolam sedation in cataract surgery and found lower intraoperative pain and improved ocular immobility with the block.<sup>9</sup> Patients receiving sedation reported greater relaxation, but the surgical field was less stable due to minor ocular movement.<sup>9</sup> These findings confirmed that regional blocks remain preferable for longer or complex surgeries where precision and immobility are essential.<sup>9</sup>

Rajan et al. evaluated sub-Tenon's block versus systemic sedation in glaucoma surgery and observed superior akinesia and fewer intraoperative complications with the block.<sup>10</sup> The sub-Tenon's approach provided excellent analgesia and minimized the risk of globe perforation compared with retrobulbar injections.<sup>10</sup> Furthermore, the study highlighted improved surgeon satisfaction due to consistent ocular stability under regional anesthesia.<sup>10</sup>

Kumar et al. analyzed retrobulbar blocks and intravenous sedation in cataract surgery, reporting similar levels of patient satisfaction but significantly greater akinesia with regional anesthesia.<sup>11</sup> These results support the continued use of regional techniques for patients with high anxiety or poor cooperation, where ocular motion can compromise surgical outcomes.<sup>11</sup> The authors emphasized that sedation alone is more suitable for calm, cooperative patients undergoing short procedures.<sup>11</sup>

Chou et al. compared topical anesthesia combined with sedation versus peribulbar block in 150 cataract surgeries and found shorter recovery times and higher comfort levels in the sedation group.<sup>12</sup> Nevertheless, peribulbar anesthesia provided better control of intraocular pressure and ocular stability, reducing intraoperative complications.<sup>12</sup> This trade-off suggests that sedation may enhance efficiency, whereas blocks offer superior operative precision.<sup>12</sup>

Lee et al. investigated sub-Tenon's block versus propofol sedation in vitreoretinal procedures and found that regional anesthesia achieved lower pain scores and fewer hemodynamic fluctuations.<sup>13</sup> Patients under sedation experienced greater variability in blood pressure and heart rate despite comparable analgesic satisfaction.<sup>13</sup> These results confirm that regional anesthesia is particularly advantageous in lengthy, delicate posterior segment surgeries.<sup>13</sup>

Patel et al. studied 200 cataract patients and demonstrated that surgeon comfort and operative control were significantly better with peribulbar block than with systemic sedation.<sup>14</sup> However, patient comfort and perceived satisfaction were marginally higher with sedation due to anxiolytic effects.<sup>14</sup> The authors proposed a combined approach—regional block with minimal sedation—to optimize outcomes and minimize risks.<sup>14</sup>

Abdelaziz et al. directly tested this hybrid approach, showing that sub-Tenon's block combined with light sedation achieved the best balance between analgesia and satisfaction.<sup>15</sup> The combination reduced patient anxiety and improved cooperation without increasing cardiorespiratory complications.<sup>15</sup> Consequently, balanced anesthesia integrating both modalities is now widely recommended for selected cases.<sup>15</sup>

Lin et al. evaluated elderly cataract patients and found that regional blocks produced fewer respiratory events and less oxygen desaturation than systemic sedation.<sup>16</sup> In older adults, sedation-related hypoventilation and hypotension represent major perioperative risks, reinforcing the safety profile of regional anesthesia.<sup>16</sup> This study supports prioritizing ocular blocks in frail patients with cardiopulmonary comorbidities.<sup>16</sup>

Chhabra et al. examined glaucoma procedures and confirmed that peribulbar anesthesia resulted in greater hemodynamic stability and reduced intraoperative blood



pressure variability compared with sedation.<sup>17</sup> These findings are particularly relevant for patients with vascular fragility or optic neuropathy, where maintaining stable perfusion is crucial.<sup>17</sup> Regional techniques therefore contribute to safer surgical conditions in this subset of patients.<sup>17</sup>

Bui et al. conducted a prospective comparison of 250 phacoemulsification cases using topical anesthesia with sedation versus peribulbar block.<sup>18</sup> While sedation improved subjective comfort, blocks ensured better ocular immobility and surgeon satisfaction.<sup>18</sup> These findings highlight the practical need to match anesthetic technique with procedural complexity and patient profile.<sup>18</sup>

Ryu et al. explored dexmedetomidine sedation versus peribulbar block in vitreoretinal surgery and found that sedation maintained hemodynamic control but allowed small eye movements that affected precision.<sup>19</sup> Conversely, regional blocks completely immobilized the globe, yielding a more controlled surgical environment.<sup>19</sup> The study concluded that block anesthesia should remain the standard for posterior segment interventions.<sup>19</sup>

Al-Hassan et al. compared sub-Tenon's block with propofol sedation and found equivalent satisfaction but faster discharge among sedated patients.<sup>20</sup> However, regional anesthesia showed greater intraoperative stability and fewer systemic adverse events.<sup>20</sup> These results reinforce the efficiency of sedation for outpatient settings while confirming the safety advantage of blocks in hospital-based surgeries.<sup>20</sup>

Singh et al. studied diabetic retinopathy cases and revealed that regional anesthesia provided superior hemodynamic stability relative to systemic sedation.<sup>21</sup> Diabetic patients often present autonomic dysfunction, increasing the risk of intraoperative fluctuations under sedation.<sup>21</sup> Hence, ocular blocks offer greater predictability in high-risk metabolic populations.<sup>21</sup>

Pereira et al. compared anesthesia techniques across multiple ophthalmic procedures and found a higher incidence of hypotension and hypoxia in the sedation group.<sup>22</sup> Regional anesthesia demonstrated shorter recovery times once systemic monitoring was accounted for, underscoring its perioperative efficiency.<sup>22</sup> These results affirm the reliability of blocks when systemic reserve is limited.<sup>22</sup>

Ahmed et al. evaluated sub-Tenon's block with adjunctive light sedation in glaucoma patients and showed that mild sedation improved patient relaxation without compromising respiratory safety.<sup>23</sup> The hybrid technique enhanced patient–surgeon communication and overall experience.<sup>23</sup> This balanced strategy illustrates the evolving paradigm of individualized ophthalmic anesthesia.<sup>23</sup>

Nakamura et al. compared peribulbar anesthesia with midazolam sedation and observed greater surgeon satisfaction and surgical stability with the block.<sup>24</sup> Although sedation reduced preoperative anxiety, minor ocular movements occasionally prolonged operative time.<sup>24</sup> These findings support limiting sedation-only protocols to simple anterior segment cases.<sup>24</sup>

Tewari et al. assessed block versus dexmedetomidine sedation in vitreoretinal surgery and found that regional anesthesia provided superior analgesia and reduced sympathetic activation.<sup>25</sup> Sedation resulted in faster discharge but required intensive intraoperative monitoring.<sup>25</sup> The authors recommended regional anesthesia for complex or lengthy procedures and sedation for short ambulatory cases.<sup>25</sup>

Gonzalez et al. analyzed sub-Tenon's block and systemic sedation in cataract patients, finding similar comfort levels but fewer systemic side effects in the block group.<sup>26</sup> Their data confirmed that sub-Tenon's anesthesia offers an optimal balance between safety and patient satisfaction.<sup>26</sup> As a result, this technique is increasingly preferred in modern ophthalmic centers.<sup>26</sup>

When synthesized, the reviewed evidence confirms that regional ocular anesthesia ensures better intraoperative stability, less systemic disturbance, and superior akinesia compared with sedation.<sup>27</sup> Systemic sedation alone is acceptable for short, low-pain procedures but carries higher cardiorespiratory risk in elderly and comorbid patients.<sup>27</sup> Combining both modalities through minimal sedation alongside a regional block provides the most favorable compromise between safety, efficiency, and comfort.<sup>27</sup>

Recent consensus statements from ophthalmic anesthesia societies endorse personalized anesthetic selection based on surgery type, patient risk profile, and operator experience.<sup>28</sup> The GRADE assessment indicates moderate certainty of evidence for pain and akinesia, and low certainty for satisfaction outcomes due to subjective variability.<sup>28</sup> Overall, regional ocular blocks—particularly sub-Tenon's—remain the gold standard for most ophthalmic procedures requiring ocular immobility.<sup>28</sup>

## 6 CONCLUSION

The evidence synthesized in this systematic review demonstrates that regional ocular blocks generally outperform systemic sedation in achieving intraoperative stability, ocular akinesia, and analgesic control during ophthalmic surgeries. These advantages are particularly relevant for complex or lengthy procedures such as glaucoma filtration and vitreoretinal surgeries. Systemic sedation, however, offers advantages in reducing anxiety and facilitating faster postoperative recovery in brief, low-pain procedures such as

uncomplicated phacoemulsification. The findings support a context-dependent approach rather than universal preference for either modality.

From a clinical perspective, the choice between regional anesthesia and systemic sedation should consider patient comorbidities, surgical duration, and institutional resources. Regional ocular blocks—especially the sub-Tenon’s technique—are safer for elderly or high-risk patients, as they minimize respiratory and hemodynamic complications. Conversely, systemic sedation may be adequate for cooperative patients in ambulatory settings when rapid turnover and minimal invasiveness are priorities. The integration of both modalities offers the most effective balance of comfort, safety, and efficiency.

The primary limitations identified across the literature include small sample sizes, short follow-up periods, and heterogeneity in anesthetic protocols and outcome measures. Variability in surgeon skill, patient selection, and sedative dosing complicates direct comparison between studies. Moreover, differences in pain and satisfaction assessment tools reduce the precision of pooled conclusions. These methodological limitations restrict the certainty of evidence and highlight the need for standardized reporting criteria in ophthalmic anesthesia research.

Future investigations should prioritize large, multicenter randomized controlled trials comparing specific ocular block types and sedation regimens across diverse surgical contexts. Incorporating objective endpoints such as hemodynamic variability, recovery time, and patient-reported outcome measures will improve external validity. The adoption of GRADE and PRISMA frameworks will enhance methodological rigor and facilitate guideline development. Studies exploring combined regional and light-sedation strategies may establish evidence-based protocols for optimizing safety and satisfaction.

Ultimately, the balance between patient comfort, surgical precision, and systemic safety underscores the need for evidence-based, multidisciplinary, and individualized approaches to ophthalmic anesthesia. Anesthetic decisions should integrate surgical complexity, anesthesiologist expertise, and patient preference. By aligning clinical practice with the current evidence, ophthalmologists and anesthesiologists can ensure optimal outcomes, promoting both safety and satisfaction in modern ophthalmic surgery.

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