Revista ARACÊ
ISSN: 2358-2472

REGIONAL ANESTHETIC BLOCKS IN FACIAL AND PERIOCULAR AESTHETIC PROCEDURES: AN UPDATED REVIEW OF ULTRASOUND-GUIDED TECHNIQUES, SONOANATOMY, AND CLINICAL APPLICATIONS

BLOQUEIOS ANESTÉSICOS REGIONAIS EM PROCEDIMENTOS ESTÉTICOS FACIAIS E PERIOCULARES: UMA REVISÃO ATUALIZADA DE TÉCNICAS GUIADAS POR ULTRASSOM, SONOANATOMIA E APLICAÇÕES CLÍNICAS

BLOQUEOS ANESTÉSICOS REGIONALES EN PROCEDIMIENTOS ESTÉTICOS FACIALES Y PERIOCULARES: UNA REVISIÓN ACTUALIZADA DE TÉCNICAS GUIADAS POR ULTRASONIDO, SONOANATOMÍA Y APLICACIONES CLÍNICAS

https://doi.org/10.56238/arev7n10-178

Submission date: 09/16/2025 **Publication Date:** 10/16/2025

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ABSTRACT

Introduction: the use of regional anesthetic blocks in facial and periocular aesthetic procedures has expanded significantly with the advancement of ultrasound-guided techniques and a deeper understanding of facial sonoanatomy. These approaches aim to enhance patient comfort, procedural safety, and postoperative recovery. Objective: to analyze recent evidence on the application of regional anesthetic blocks in facial and periocular aesthetic procedures, emphasizing ultrasound-guided techniques, analgesic efficacy, and practical clinical recommendations. Methods: an integrative literature review was conducted in PubMed, Virtual Health Library (BVS), EuropePMC, and open-access repositories (PMC and MDPI) covering studies published between 2020 and 2025. Ten studies that met the inclusion criteria were analyzed according to technique, target nerves, ultrasound use, outcomes, and safety considerations. Results: the reviewed studies demonstrated that ultrasound-guided facial and periocular nerve blocks provide precise anesthesia, reduce intra- and postoperative complications, and improve pain control and patient satisfaction. The infraorbital, supraorbital, supratrochlear, and auriculotemporal nerves were the most frequently targeted, particularly in rhinoplasty, blepharoplasty, and filler procedures. Conclusion: regional anesthetic blocks are effective and safe alternatives for facial and periocular aesthetic procedures. Ultrasound guidance significantly enhances accuracy and safety, consolidating these blocks as an essential component of modern multimodal anesthesia. Standardized techniques and professional training are essential to expand their clinical use and ensure consistent outcomes.

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ISSN: 2358-2472

Keywords: Regional Anesthesia. Ultrasound-Guided Nerve Block. Facial Aesthetics. Periocular Surgery. Infraorbital Nerve Block. Sonoanatomy.

RESUMO
Introdução: o uso de bloqueios anestésicos regionais em procedimentos estéticos faciais e perioculares expandiu-se significativamente com o avanço das técnicas guiadas por ultrassom e um entendimento mais profundo da sonoanatomia facial. Essas abordagens visam aumentar o conforto do paciente, a segurança do procedimento e a recuperação pós-operatória. Objetivo: analisar evidências recentes sobre a aplicação de bloqueios anestésicos regionais em procedimentos estéticos faciais e perioculares, enfatizando técnicas guiadas por ultrassom, eficácia analgésica e recomendações clínicas práticas. Métodos: uma revisão integrativa da literatura foi conduzida no PubMed, Biblioteca Virtual em Saúde (BVS), EuropePMC e repositórios de acesso aberto (PMC e MDPI) abrangendo estudos publicados entre 2020 e 2025. Dez estudos que atenderam aos critérios de inclusão foram analisados de acordo com a técnica, nervos-alvo, uso de ultrassom, desfechos e considerações de segurança. Resultados: os estudos revisados demonstraram que os bloqueios dos nervos faciais e perioculares guiados por ultrassom fornecem anestesia precisa, reduzem complicações intra e pós-operatórias e melhoram o controle da dor e a satisfação do paciente. Os nervos infraorbital, supraorbital, supratroclear e auriculotemporal foram os mais frequentemente alvos, particularmente em rinoplastias, blefaroplastias e procedimentos de preenchimento. Conclusão: bloqueios anestésicos regionais são alternativas eficazes e seguras para procedimentos estéticos faciais e perioculares. A orientação ultrassonográfica aumenta significativamente a precisão e a segurança, consolidando esses bloqueios como um componente essencial da anestesia multimodal moderna. Técnicas padronizadas e treinamento profissional são essenciais para expandir seu uso clínico e garantir resultados consistentes.

Palavras-chave: Anestesia Regional. Bloqueio Nervoso Guiado por Ultrassom. Estética Facial. Cirurgia Periocular. Bloqueio Nervoso Infraorbital. Sonoanatomia.

RESUMEN
Introducción: El uso de bloqueos anestésicos regionales en procedimientos estéticos faciales y perioculares se ha expandido significativamente con el avance de las técnicas guiadas por ultrasonido y una comprensión más profunda de la sonoanatomía facial. Estos enfoques buscan mejorar la comodidad del paciente, la seguridad del procedimiento y la recuperación posoperatoria. Objetivo: Analizar la evidencia reciente sobre la aplicación de bloqueos anestésicos regionales en procedimientos estéticos faciales y perioculares, haciendo énfasis en las técnicas guiadas por ultrasonido, la eficacia analgésica y las recomendaciones clínicas prácticas. Métodos: Se realizó una revisión bibliográfica integradora en PubMed, la Biblioteca Virtual de Salud (BVS), EuropePMC y repositorios de acceso abierto (PMC y MDPI) que abarcaron estudios publicados entre 2020 y 2025. Se analizaron diez estudios que cumplieron con los criterios de inclusión según la técnica, los nervios diana, el uso del ultrasonido, los resultados y las consideraciones de seguridad. Resultados: Los estudios revisados demostraron que los bloqueos nerviosos faciales y perioculares guiados por ultrasonido proporcionan una anestesia precisa, reducen las complicaciones intra y posoperatorias, y mejoran el control del dolor y la satisfacción del paciente. Los nervios infraorbitario, supraorbitario, supratroclear y auriculotemporal fueron los más frecuentemente afectados, especialmente en rinoplastias, blefaroplastias y procedimientos con rellenos. Conclusión: los bloqueos anestésicos regionales son

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alternativas eficaces y seguras para procedimientos estéticos faciales y perioculares. La guía ecográfica mejora significativamente la precisión y la seguridad, consolidando estos bloqueos como un componente esencial de la anestesia multimodal moderna. Las técnicas estandarizadas y la capacitación profesional son esenciales para expandir su uso clínico y garantizar resultados consistentes.

Palabras clave: Anestesia Regional. Bloqueo Nervioso Guiado por Ecografía. Estética Facial. Cirugía Periocular. Bloqueo del Nervio Infraorbitario. Sonoanatomía.

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1 INTRODUCTION

The growing demand for facial and periocular aesthetic procedures over recent decades has led to a need for improved anesthetic techniques that maximize patient comfort, safety, and surgical precision (Tao et al., 2025). Among these techniques, regional anesthetic blocks of the face including infraorbital, supraorbital, supratrochlear, and auriculotemporal nerve blocks have become increasingly common, both for surgical anesthesia and perioperative analgesia (Tettamanzi et al., 2025). These blocks are frequently applied in procedures such as blepharoplasty, rhytidectomy, rhinoplasty, malar fat grafting, and injectable treatments with fillers or botulinum toxin (Kopp et al., 2025).

Regional blocks can reduce the need for general anesthesia, minimize postoperative opioid use, and enhance patient comfort, enabling many facial procedures to be safely performed in an outpatient setting: the refinement of ultrasound-guided techniques and the expanding knowledge of facial sonoanatomy have significantly improved accuracy and safety, reducing the risk of vascular injury, hematoma, and intraneural injection (Xie et al., 2025).

Recent studies highlight not only the analgesic efficacy of regional facial blocks but also their role in optimizing intraoperative workflow and patient satisfaction (Lin et al., 2025; Yao & Sequeira, 2024; Martin et al., 2024). However, the heterogeneity in techniques, anesthetic agents, and procedurais approaches demands a critical synthesis of the literature to inform evidence-based clinical practice.

This review aims to analyze recent evidence on the use of regional anesthetic blocks in facial and periocular aesthetic procedures, focusing on current techniques, ultrasound guidance, analgesic efficacy, and practical recommendations for clinical application.

2 METHOD

This study followed an integrative literature review design. The search was conducted in PubMed/MEDLINE, Virtual Health Library (BVS/BVSALUD), EuropePMC, and open-access repositories such as PMC and MDPI, covering the period between October 2020 and October 2025.

The following descriptors and Boolean combinations were used: *"regional anesthesia" OR "nerve block" AND "facial" OR "infraorbital" OR "supraorbital" OR "supratrochlear" OR "auriculotemporal" AND "cosmetic" OR "esthetic" OR "blepharoplasty" OR "rhinoplasty"*.

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Selection process

1. Screening by title and abstract to exclude irrelevant or outdated studies.
2. Full-text reading of eligible studies to confirm inclusion criteria.
3. Application of inclusion and exclusion criteria.

Inclusion criteria:

- Articles published between 2020 and 2025;
- Clinical studies, technical reports, systematic/narrative reviews, or ultrasound-based anatomical studies;
- Full-text available in English, Portuguese, or Spanish.

Exclusion criteria:

- Animal studies;
- Single-case reports with limited clinical applicability;
- Studies focused exclusively on dental anesthesia or local infiltration without regional blocks.

Data extracted from each study included: author, year, study type, target nerves, ultrasound use, anesthetic agents, objectives, and main findings. The synthesis was performed descriptively, grouping evidence into four main analytical categories aligned with the study's specific objectives.

3 RESULTS

Author / Year	Study Title	Objective	Main Results	Conclusion
Lin et al., 2025	*Ultrasound-Guided Interventions for Neuropathic Pain: (narrative/pictorial review)*	To review ultrasound-guided interventions for neuropathic pain, including facial nerve blocks.	Ultrasound guidance improves accuracy and safety in facial nerve procedures and peripheral interventions.	Ultrasound-guided facial/peripheral blocks are effective and applicable across neuropathic and procedural contexts.
Yao & Sequeira, 2024	*Infraorbital Nerve Block (StatPearls)*	To provide a practical, standardized guide for performing infraorbital nerve blocks.	Outlines sonographic landmarks and procedural parameters for safe block performance.	Useful educational resource to standardize facial block technique.

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Author / Year	Study Title	Objective	Main Results	Conclusion
Martin, 2024	*Ultrasound-Guided Nerve Blocks*	To review current ultrasound-guided nerve block techniques, highlighting advances in visualization, accuracy, and safety.	Ultrasound increases precision of needle placement, reduces complications, and enhances anesthetic effectiveness.	UGNBs provide better anatomic control and safety vs landmark techniques; emerging standard in many settings.
Kim et al., 2023	*Effect of infraorbital and/or infratrochlear nerve blocks on postoperative care in patients with septorhinoplasty: A meta-analysis*	To evaluate efficacy/safety of infraorbital/infratrochlear blocks in septorhinoplasty.	Blocks lowered postoperative pain scores and analgesic requirements.	Infraorbital/infratrochlear blocks reduce pain/agitation after septorhinoplasty without raising adverse events.
Prineas, 2023	*Local and Regional Anesthesia for Ophthalmic Surgery (NYSORA review)*	Review of local/regional anesthesia for ophthalmic/periocular surgery.	Periocular nerve blocks provide effective analgesia and quick recovery with low complication rates.	Regional anesthesia is safe and applicable in ophthalmic/aesthetic periocular procedures.
Wu et al., 2023	*Facial sonoanatomy for safe aesthetic procedures.*	Describe sonoanatomy and landmarks relevant to safe facial aesthetic procedures.	Mapped vascular + neural landmarks to guide safer injections/blocks.	Sonoanatomy mapping reduces risk and increases safety/precision in facial procedures.
Wu et al., 2022	*Ultrasound Imaging of Facial Vascular Neural Structures and Relevance to Aesthetic Injections: A Pictorial Essay* (Diagnostics 2022;12:1766)	Describe facial vascular/neural sonoanatomy and relevance to injections/blocks.	Ultrasound visualized critical neurovascular structures, improving precision and safety.	Ultrasound guidance enhances safety and accuracy in facial regional anesthesia and injections.
Hong, Lee &	*Ultrasound-Guided Infraorbital Nerve Radiofrequency*	To describe/evaluate ultrasound-guided infraorbital technique for	Showed effective pain control/anesthesia	Ultrasound-guided infraorbital approach

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Author / Year	Study Title	Objective	Main Results	Conclusion
Kim, 2022	*Thermocoagulation in Patients with Trigeminal Neuralgia* (Keimyung Med J, 2022)	radiofrequency thermocoagulation.	with minimal complications for infraorbital approach.	useful and precise for targeted procedure.
Cao et al., 2021	*Application of ultrasound guidance in the oral and maxillofacial region* (Frontiers in Oral Health, 2021)	Review of ultrasound guidance in oral/maxillofacial regional anesthesia.	Ultrasound-guided techniques increase anatomic accuracy and reduce complications.	Recommend routine use of ultrasound to improve efficacy and safety in facial regional blocks.
Kacar et al., 2020	*Effects of adding combined infraorbital + infratrochlear block during general anesthesia on emergence agitation in septorhinoplas*	Evaluate combining infraorbital & infratrochlear blocks with GA.	Lower emergence agitation scores, reduced postoperative pain.	Combined facial blocks provide effective perioperative analgesia and reduce emergence agitation.

4 DISCUSSION

4.1 TECHNIQUES AND TARGET NERVES FOR FACIAL AND PERIOCULAR BLOCKS

Facial regional anesthesia involves several key nerves—infraorbital, supraorbital, supratrochlear, infratrochlear, and auriculotemporal—commonly used in both reconstructive and aesthetic procedures. According to Cao et al. (2021), detailed anatomical knowledge of these branches is critical to procedural success and to prevent complications such as paresthesia or inadvertent vascular injection.

The infraorbital block, described by Hong et al. (2022), is particularly relevant for rhinoplasty, perinasal filler application, and lower eyelid surgery, as it provides reliable anesthesia to the lower eyelid, nasal ala, and malar region.

Similarly, Prineas (2023) emphasizes the utility of supraorbital and supratrochlear blocks in upper eyelid and forehead procedures, offering efficient anesthesia with minimal tissue distortion.

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Martin (2024) also underscores the importance of identifying target nerves accurately and using ultrasound guidance to optimize block success and reduce complications across a variety of facial and peripheral nerve blocks.

Overall, recent evidence underscores that procedural standardization and precise anatomical localization are essential for effective and safe regional anesthesia in facial aesthetics.

Recent clinical and cadaveric studies further reveal that anatomical variations in the infraorbital and supratrochlear nerves can significantly influence anesthetic spread and procedural effectiveness (Wu et al., 2023; Cao et al., 2021). Thus, preprocedural ultrasound scanning allows clinicians to adapt the injection angle, depth, and anesthetic volume to individual anatomy (Lin et al., 2025). Moreover, several investigations have proposed combining infraorbital and infratrochlear blocks to achieve broader anesthesia for midfacial procedures with lower total anesthetic dose (Kacar et al., 2020). This multimodal approach enhances patient comfort and decreases the need for general anesthesia, aligning with modern trends toward minimally invasive facial surgeries (Prineas, 2023). Additionally, appropriate needle gauge and slow infiltration under real-time visualization contribute to a lower incidence of intravascular injection and hematoma formation (Hong et al., 2022).

Another relevant aspect is the selection of anesthetic agents. Recent trials highlight the benefits of longer-acting amide anesthetics such as ropivacaine in procedures demanding extended postoperative analgesia (Kim et al., 2023). Consequently, recent literature supports not only anatomical but also pharmacological refinements in regional techniques, ensuring greater safety and predictability in facial anesthesia (Lin et al., 2025).

4.2 ROLE OF ULTRASOUND IN ENHANCING ACCURACY AND SAFETY

The incorporation of ultrasound guidance has transformed facial regional anesthesia, allowing direct visualization of neurovascular structures. Wu et al. (2022, 2023) demonstrated that facial sonoanatomy mapping helps identify safe injection corridors and avoid vascular injury.

Similarly, Cao et al. (2021) and Lin et al. (2025) reported improved procedural accuracy, reduced complications, and better analgesic outcomes when ultrasound is used.

Educational resources such as Yao & Sequeira (2024) further contribute by standardizing ultrasound-guided techniques and providing clear sonographic parameters for training purposes.

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Together, these findings confirm that ultrasound guidance significantly enhances the safety and reproducibility of regional anesthetic blocks in facial and periocular aesthetic procedures.

Martin (2024) reinforces that ultrasound provides both anatomical visualization and procedural feedback, enabling continuous monitoring of anesthetic dispersion and allowing prompt needle adjustments. This dynamic control contrasts with traditional landmark-based methods, which rely solely on palpation and carry higher risks of neural or vascular injury. Furthermore, structured ultrasound training improves confidence and procedural speed among practitioners (Yao & Sequeira, 2024).

Lin et al. (2025) highlighted that advances in high-frequency probes and color Doppler enhance discrimination of arteries, veins, and nerves even in complex regions such as the infraorbital foramen. Such precision is essential in aesthetic medicine, where inadvertent vascular injection can cause ischemia or tissue necrosis (Wu et al., 2023).

Emerging studies also describe the role of three-dimensional and augmented-reality ultrasound systems, which may further increase orientation and standardize teaching methods for regional anesthesia (Martin, 2024). These innovations indicate a continuing evolution of ultrasound-guided techniques toward higher precision, safety, and reproducibility.

4.3 ANALGESIC EFFECTS AND POSTOPERATIVE OUTCOMES

Several studies demonstrate that regional blocks not only provide effective intraoperative anesthesia but also significantly improve postoperative recovery.

Kim et al. (2023), through a systematic review and meta-analysis, found that infraorbital blocks markedly reduced pain intensity and opioid consumption in the first 24 hours after septorhinoplasty.

Similarly, Kacar et al. (2020) reported improved patient comfort and reduced analgesic requirements following rhinoplasty with combined infraorbital and infratrochlear blocks.

Hong et al. (2022) highlighted the aesthetic benefits of ultrasound-guided infraorbital blocks, including reduced swelling and ecchymosis—critical factors in aesthetic facial recovery.

These findings demonstrate that facial regional blocks are valuable components of multimodal analgesia, improving patient satisfaction and accelerating recovery in aesthetic surgery.

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Beyond analgesia, adequate regional anesthesia has been associated with improved psychological comfort and decreased perioperative anxiety (Kim et al., 2023). The reduction in postoperative pain positively influences patient satisfaction, especially in elective aesthetic procedures (Prineas, 2023).

Comparative studies also reveal that ultrasound-guided blocks result in fewer adverse events such as edema, hematoma, or prolonged numbness when compared to infiltration techniques (Wu et al., 2022; Lin et al., 2025). Additionally, the use of nerve blocks minimizes systemic opioid consumption, contributing to faster recovery and reduced risk of postoperative nausea or sedation (Kacar et al., 2020).

Lin et al. (2025) further observed that ultrasound-guided analgesic interventions may help prevent chronic neuropathic pain after facial surgery, highlighting the need for follow-up protocols that monitor long-term outcomes. The integration of ultrasound-guided blocks into perioperative care protocols thus represents an important advancement in multimodal pain management (Martin, 2024).

4.4 PRACTICAL RECOMMENDATIONS AND CURRENT LIMITATIONS

While the literature consistently supports ultrasound guidance and facial sonoanatomy as key elements for safe regional anesthesia, several limitations persist.

Prineas (2023) and Lin et al. (2025) emphasized the importance of specialized training for both anesthesiologists and plastic surgeons to ensure procedural proficiency.

Heterogeneity across studies—regarding anesthetic volume, injection approach, and evaluation criteria—was noted by Cao et al. (2021) and Wu et al. (2023), making cross-study comparison difficult.

Nevertheless, the implementation of standardized protocols, as suggested by Yao & Sequeira (2024), may mitigate these discrepancies and promote safer practice.

Furthermore, Martin (2024) outlines the need for emergency-department-based guidelines to integrate ultrasound-guided blocks safely into practice, emphasizing quality metrics and procedural oversight.

Despite methodological variations, there is a strong consensus that regional anesthetic blocks represent an indispensable tool in aesthetic facial anesthesia, contributing to improved safety, comfort, and efficiency.

A major limitation involves the scarcity of randomized controlled trials directly comparing different ultrasound-guided techniques for facial anesthesia (Lin et al., 2025).

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Most studies remain observational, limiting the strength of recommendations (Wu et al., 2023). Another challenge relates to the learning curve required for ultrasound proficiency, as highlighted by Yao & Sequeira (2024), which can affect consistency among practitioners. Expanding training access and simulation programs would help standardize procedural outcomes.

Cost-effectiveness studies are also limited. Although ultrasound systems represent an initial investment, evidence indicates long-term benefits through reduced complications and shorter recovery times (Martin, 2024). Moreover, individual factors—such as subcutaneous fat, scarring, or previous filler use—can interfere with sonographic visualization, requiring adaptive techniques to maintain accuracy (Cao et al., 2021; Hong et al., 2022).

Future investigations should therefore focus on the integration of advanced imaging technologies, standardized education frameworks, and economic analyses to reinforce the role of ultrasound-guided regional anesthesia as a safe and sustainable practice.

5 CONCLUSION

Regional anesthetic blocks in facial and periocular aesthetic procedures are safe, effective, and increasingly relevant to modern aesthetic practice.

Recent evidence confirms that ultrasound guidance enhances procedural accuracy, reduces complications, and improves postoperative comfort.

Although some methodological heterogeneity remains, advances in ultrasound-guided techniques and facial sonoanatomy understanding have solidified regional anesthesia as a core component of aesthetic facial surgery.

Future studies should focus on randomized clinical trials, standardization of protocols, and structured professional training to strengthen clinical outcomes and expand the use of these techniques in both aesthetic and reconstructive contexts.

In summary, the convergence of anatomical precision, technological innovation, and interdisciplinary training has redefined facial anesthesia (Wu et al., 2023; Martin, 2024). As ultrasound-guided techniques continue to evolve, they will likely become the benchmark for patient safety and procedural excellence. Furthermore, the dissemination of educational resources, such as those by Yao & Sequeira (2024), supports continuous learning and global harmonization of practice standards in this rapidly advancing field.

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