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INTEGRATED STUDY MASTER’S FINAL THESIS

Lower Eyelid Blepharoplasty: Indications, Surgical Techniques, Results, Complications

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Abbreviations

IOM - Inferior oblique muscle.

OOM - Orbicularis oculi muscle.

ORL - Orbicularis retaining ligament.

SOOF - Suborbicularis oculi fat.

TTL - Tear trough ligament.

ZCL - Zygomaticocutaneous ligament.

ASPS - American Society of Plastic Surgeons.

MAFT - Micro-autologous fat transplantation.

CN VII - Cranial Nerve VII.

LASIK - Laser-Assisted in Situ Keratomileusis.

Abstract

This thesis reviews lower eyelid blepharoplasty, with a focus on how anatomical findings such as orbital fat pseudoherniation, lower eyelid skin excess, eyelid laxity, orbital vector, and lid-cheek contour influence the choice between transconjunctival and transcutaneous lower eyelid blepharoplasty. In addition, the review examined the role of fat excision, fat repositioning, and arcus marginalis release in contemporary lower eyelid rejuvenation. Because severe complications such as ectropion or lower eyelid retraction may require reconstructive correction, selected reconstructive techniques were included as a supporting part of the review.

This thesis was conducted as a structured non-systematic literature review. The literature search was performed between August and November 2025 and updated in March 2026. A total of 40 sources were included in the final qualitative review, comprising clinical studies, anatomical studies, review articles, reconstructive surgery literature, and epidemiological reports. The PRISMA 2020 statement was cited separately as a methodological reporting reference and was not counted among the 40 sources included in the qualitative synthesis. Original clinical studies were prioritized when discussing surgical outcomes, while anatomical and review articles were used to support background and surgical planning sections.

The available evidence does not indicate that either the transconjunctival or transcutaneous approach is universally superior. Instead, the choice should be guided by the dominant anatomical problem. Transconjunctival access is most appropriate when orbital fat prominence is the main finding and lower eyelid skin quality is relatively preserved. In contrast, a transcutaneous approach remains necessary when skin redundancy, orbicularis laxity, or direct anterior lamellar correction are clinically relevant. Rather than supporting one universally superior technique, current evidence suggests that surgical planning should be individualized according to anatomical findings, eyelid support, tissue quality, and patient-specific risk factors.

Contemporary lower eyelid blepharoplasty increasingly emphasizes conservative and volume-preserving strategies. Fat repositioning with arcus marginalis release appears most relevant in patients in whom prominent orbital fat is accompanied by infraorbital hollowing or loss of a smooth eyelid-cheek transition. A clear comparison is difficult, however, because the studies use different patient groups, surgical modifications, follow-up periods, and outcome definitions. Therefore, the superiority of fat repositioning over conservative fat excision cannot be concluded definitively.

Complications remain a central concern in lower eyelid blepharoplasty. Lower eyelid malposition, ectropion, retraction, chemosis, asymmetry, dry eye symptoms, diplopia, and retrobulbar hemorrhage are described in the literature, although their reported frequency varies considerably between studies. Prevention depends less on the surgical approach alone and more on careful preoperative assessment, conservative tissue handling, appropriate fat management, and the use of canthal support procedures

in patients with increased anatomical risk. Reconstructive principles, including local flaps and graft-based techniques, are relevant for understanding lamellar support and for managing severe tissue deficiency or postoperative malposition.

The reviewed literature supports an individualized, anatomically guided approach to lower eyelid blepharoplasty. While many studies report favorable aesthetic outcomes and high patient satisfaction, these findings must be interpreted cautiously because outcome assessment is often subjective and non-standardized. Future studies should include longer follow-up, clearer reporting of complications, and validated patient-reported outcome measures.

Santrauka

Šiame darbe apžvelgiama apatinio voko blefaroplastika, daugiausia dėmesio skiriant tam, kaip anatominiai veiksniai lemia chirurginio metodo pasirinkimą. Darbo tikslas buvo įvertinti, kaip orbitinių riebalų pseudoherniacija, apatinio voko odos perteklius, voko laisvumas, orbitinis vektorius ir voko–skruosto jungties kontūras daro įtaką pasirinkimui tarp transkonjunktyvinės ir transkutaninės apatinio voko blefaroplastikos. Be to, šiame darbe nagrinėjamas riebalų pašalinimo, riebalų perkėlimo ir arcus marginalis atlaisvinimo vaidmuo šiuolaikinėje apatinio voko atjauninimo chirurgijoje. Kadangi sunkios komplikacijos, tokios kaip ektropionas ar apatinio voko retrakcija, gali reikalauti rekonstrukcinės korekcijos, pasirinkti rekonstrukciniai principai taip pat įtraukti kaip pagalbinė apžvalgos dalis.

Darbas atliktas kaip struktūruota nesisteminė literatūros apžvalga. Literatūros paieška buvo vykdyta PubMed, ScienceDirect, Springer, Thieme Connect ir Elsevier duomenų bazėse nuo 2025 m. rugpjūčio iki lapkričio mėnesio, o paieška atnaujinta 2026 m. kovo mėnesį. Galutinei kokybinei analizei atrinkta 40 šaltinių. Pirmenybė buvo teikiama originaliems klinikiniams tyrimams, o anatominiai, apžvalginiai ir rekonstrukcinės chirurgijos šaltiniai buvo naudoti teoriniam ir klinikiniam kontekstui papildyti.

Apžvelgta literatūra rodo, kad nėra vieno universaliai pranašesnio chirurginio metodo. Transkonjunktyvinis metodas yra ypač tinkamas pacientams, kuriems vyrauja orbitinių riebalų pseudoherniacija ir yra santykinai išlikusi apatinio voko oda. Transkutaninis metodas išlieka svarbus, kai yra ryškus odos perteklius, orbicularis oculi raumens laisvumas arba reikia koreguoti priekinę lamelę. Riebalų perkėlimas ir arcus marginalis atlaisvinimas atspindi didėjantį dėmesį tūrio išsaugojimui ir kontūro atkūrimui, ypač esant ašarų vagos deformacijai ar voko–skruosto jungties įdubimui. Tačiau šių metodų pranašumas prieš konservatyvų riebalų pašalinimą nėra galutinai įrodytas.

Apibendrinant, apatinio voko blefaroplastika turėtų būti planuojama individualiai, atsižvelgiant į paciento anatomiją, audinių kokybę, voko atramą ir komplikacijų riziką. Nors daugelis tyrimų nurodo

palankius estetinius rezultatus ir didelį pacientų pasitenkinimą, šiuos duomenis reikia vertinti atsargiai dėl heterogeniškų tyrimų metodų, trumpų stebėjimo laikotarpių ir nestandartizuotų rezultatų vertinimo priemonių.

Keywords

Lower Eyelid Blepharoplasty; Fat Repositioning; Transconjunctival Approach; Transcutaneous Approach; Complications; Aesthetic Outcomes

1 Introduction

1.1 Background

Lower eyelid blepharoplasty includes a range of surgical techniques used to correct age-related lower eyelid fullness, skin redundancy, and contour irregularities (1,2). These findings are often associated with attenuation of the orbital septum and supporting periocular tissues, which can make the orbital fat pads prominent and contribute to a less defined lid-cheek transition (1). Consequently, lower eyelid blepharoplasty has become an established procedure in aesthetic and reconstructive facial surgery, with the aim of restoring a smoother and more balanced periorbital contour (1,2).

The two principal approaches used in lower eyelid blepharoplasty are the transconjunctival and transcutaneous techniques. In clinical practice, the transconjunctival route is most useful when the dominant problem is orbital fat prominence, and the lower eyelid skin envelope remains relatively preserved. In contrast, an external transcutaneous incision is usually selected when skin redundancy, orbicularis laxity, or combined anterior lamellar correction must be addressed (2–4).

1.2 Rationale and Problem Statement

A wide range of operative techniques has been described for lower eyelid blepharoplasty, including fat excision, fat repositioning, skin-muscle flap techniques, canthal support procedures, and adjunctive resurfacing or volume restoration. However, the available literature remains heterogeneous regarding patient selection, surgical technique, outcome assessment, and follow-up duration.

Consequently, clear consensus regarding the optimal surgical approach remains limited. No single technique can currently be recommended for all patients, and operative planning must be individualized according to anatomical characteristics, degree of skin laxity, fat distribution, eyelid tone, orbital vector, and patient expectations. This creates a clinically relevant need for a structured review of the available literature. In addition, selected reconstructive techniques are relevant because they illustrate the broader surgical spectrum of lower eyelid surgery and provide corrective options for severe tissue deficiency or postoperative malposition.

1.3 Aim and Objectives

The primary aim of this literature review is to evaluate how patient-specific anatomical findings inform selection between transconjunctival and transcutaneous approaches in lower eyelid blepharoplasty. A central focus is placed on comparing traditional fat excision with fat repositioning, specifically involving arcus marginalis release, to assess whether the available literature suggests potential clinical advantages over purely subtractive methods. Furthermore, this thesis examines the relevance of selected reconstructive principles, including local flaps and graft-based techniques, for understanding and managing severe structural complications such as lower eyelid malposition after aesthetic surgery.

To achieve this overarching aim, several specific objectives are pursued. First, the anatomical relevance of the lamellar structures and the lid-cheek junction is analyzed to determine their precise influence on surgical decision-making. This is followed by an evaluation of the periorbital aging process, examining how skeletal remodeling and soft tissue descent contribute to the characteristic "double-convex deformity" and inform resulting surgical indications. Building on this, the review contrasts the transconjunctival and transcutaneous operative routes regarding their specific indications, advantages, and risks, while prioritizing patient safety and the preservation of anterior lamellar integrity. Furthermore, fat management strategies are appraised by comparing the clinical outcomes of fat repositioning and arcus marginalis release with traditional excision techniques, focusing on long-term volume stability and contour restoration. An important part of this investigation involves the transfer of reconstructive principles; specifically, it evaluates how knowledge of techniques such as local flaps and grafts can be utilized to avoid or correct serious complications like ectropion or lid retraction.

1.4 Scientific and Clinical Significance

This thesis is clinically relevant because lower eyelid blepharoplasty is a commonly performed procedure in aesthetic and reconstructive surgery, but inappropriate patient selection or excessive tissue removal may lead to functional and aesthetic complications. A structured understanding of lower eyelid anatomy, age-related periorbital changes, and technique-specific risk factors is therefore essential for surgical planning. The inclusion of reconstructive lower eyelid techniques further supports the clinical relevance of the review by showing how structural complications or tissue deficiencies may require more complex surgical correction.

From a scientific perspective, this review summarizes and critically discusses the current evidence on surgical approaches, fat management, complications, and patient satisfaction. By organizing the literature according to anatomical indications and surgical decision-making, the thesis aims to support a more individualized and evidence-informed approach to lower eyelid blepharoplasty.

2 Methodology

2.1 Review Design

This thesis was designed as a structured, non-systematic literature review because the topic covers several clinically distinct but anatomically related areas of lower eyelid surgery. These include aesthetic lower eyelid blepharoplasty, fat management strategies, postoperative complications, and selected reconstructive techniques. A formal systematic review was not feasible because the available literature is heterogeneous in study design, patient selection, surgical technique, outcome assessment, and follow-up duration. Therefore, the review uses a structured search and selection process to organize the evidence thematically and to support a clinically oriented comparison of transconjunctival and transcutaneous approaches, fat excision and fat repositioning, and reconstructive options for severe lower eyelid complications. To improve methodological transparency, the source selection process was retrospectively summarized using a PRISMA-inspired flow chart. However, this thesis was not designed as a formal systematic review or meta-analysis (5).

2.2 Search Strategy

A structured literature search was executed in two distinct phases to capture both foundational and recent evidence. The initial database query occurred between August and November 2025, followed by a final updated search in March 2026. The electronic sources used for literature retrieval included PubMed, ScienceDirect, Springer, Thieme Connect, and Elsevier. Boolean search strategies using the operators AND and OR were applied across databases. The queries incorporated terms relevant to the aesthetic, functional, and reconstructive domains of the thesis. The primary keywords included "lower eyelid blepharoplasty," "transconjunctival blepharoplasty," "transcutaneous blepharoplasty," "fat repositioning," "fat transposition," "arcus marginalis release," "complications," "aesthetic outcomes," and "patient satisfaction." To cover the reconstructive expansion, supplementary terms including "Hughes procedure," "Tenzel flap," and "Mustardé flap" were integrated into the search strings.

Exact numerical search yields were retrospectively documented for PubMed search strings, whereas ScienceDirect, Springer, Thieme Connect, Elsevier, Google Scholar, and backward citation tracking were used as complementary sources for targeted identification of relevant articles.

Table 1

Search term	Initial PubMed results	Results after filters
"Lower eyelid blepharoplasty"	1.638	181
"Transconjunctival blepharoplasty"	86	9
"Transcutaneous lower blepharoplasty"	33	9
"Fat repositioning lower blepharoplasty"	139	15
"Hughes procedure lower eyelid reconstruction"	95	17
"Tenzel flap lower eyelid"	27	10
"Free tarsal graft lower eyelid"	28	3
"Auricular cartilage graft lower eyelid"	72	12
"Complications of lower eyelid blepharoplasty"	800	89
"Anatomy in lower eyelid blepharoplasty"	450	36
Total non-unique search hits	3.368	381

PubMed search strategy and search yield. PubMed results represent non-unique search hits, as overlap between search terms was expected. Filters included publication within the last ten years and free full-text availability where applicable.

A supplementary, iterative search method was employed throughout the drafting phase. This involved backward citation tracking from the reference lists of initially included articles. Additional targeted searches were conducted via Google Scholar to locate the most recent peer-reviewed publications and to clarify specific clinical variables, particularly concerning detailed fat repositioning techniques and surgical complication profiles. While multiple databases were consulted to ensure comprehensive coverage, exact numerical search yields were tracked and documented primarily for the PubMed database (Table 1.).

2.3 Inclusion and Exclusion Criteria

Explicit criteria were established to select publications meeting the clinical and anatomical scope of this review. The selected literature comprised English-language peer-reviewed publications available in full text. Priority was assigned to original clinical research, prospective studies, retrospective cohort studies, comparative studies, and case series comprising a minimum of ten patients. Foundational anatomical papers, systematic reviews, and epidemiological reports were utilized exclusively to support background information. The search focused primarily on literature published within the last ten years to capture contemporary surgical practices. Older publications were selectively included if they contained foundational surgical concepts essential to modern reconstructive techniques. Individual case reports, conference abstracts, non-English publications, and studies lacking direct relevance to the predefined surgical techniques were excluded.

2.4 Retrospective PRISMA-Style Documentation of Source Selection

To improve methodological transparency, the source selection process was retrospectively reconstructed and documented using a PRISMA-inspired flow chart. Since this thesis was designed as a structured non-systematic literature review rather than a formal systematic review, the PRISMA 2020 framework was used only as a reporting aid and was not applied as a prospective systematic review protocol.

Across the PubMed search strings, 3,368 non-unique records were identified before filtering. After applying filters for publication within the last ten years and free full-text availability where applicable, 381 PubMed records remained. Additional sources were identified through websites (n = 4), organizational reports (n = 1), and citation searching or targeted complementary searches (n = 8), including Google Scholar, ScienceDirect, Springer, Thieme Connect, Elsevier, and backward citation tracking.

Before preliminary screening, 321 records were removed for other reasons, mainly because of overlap between non-unique search hits, limited relevance after initial inspection, or lack of direct relevance to the thesis scope. A total of 73 records were retained in Zotero for preliminary screening. Of these, 29 records were excluded after title, abstract, or preliminary source screening. Consequently, 44 reports were sought for retrieval and assessed for eligibility. No reports were unavailable for retrieval. Four reports were excluded after full-text or source assessment: two because of limited relevance to the thesis focus, one because of insufficient surgical or anatomical detail, and one because it was redundant or not used in the final synthesis. In total, 40 sources were included in the final qualitative review. The final number of included sources refers to the literature analyzed in the qualitative review and does not include the PRISMA 2020 statement, which was cited separately as a methodological reporting reference.

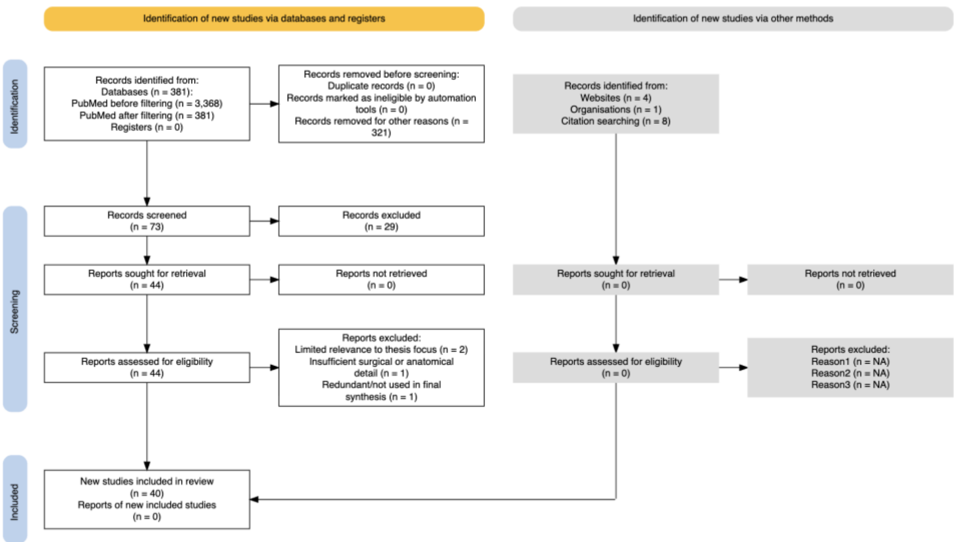

Fig 1. *Retrospectively reconstructed PRISMA-style flow chart of source selection. PubMed search strings yielded 3,368 non-unique hits before filtering and 381 non-unique hits after filtering. Additional sources were identified through websites, organizational reports, Google Scholar, Thieme Connect, Elsevier/ScienceDirect, Springer, and backward citation tracking. The flow chart refers to the 40 sources included in the qualitative review. The PRISMA 2020 statement was cited separately as a methodological reporting reference and is therefore included in the reference list but not counted as part of the reviewed literature (5).*

2.5 Data Extraction and Synthesis

Data were extracted in a structured manner from the selected literature sources. Extracted variables included study design, patient cohort size, operative technique, follow-up duration, primary clinical outcomes, reported complications, and methodological limitations. A comprehensive summary of these extracted data is provided in Appendix 1. A quantitative meta-analysis was not performed because the included studies differed substantially in study design, surgical technique, outcome measures, and follow-up duration. Consequently, a qualitative descriptive synthesis was conducted. The extracted findings were categorized and evaluated according to the core thematic domains of this thesis, including surgical access routes, fat management strategies, complication profiles, aesthetic outcomes, and patient-reported satisfaction.

3 Literature Review

3.1 Anatomy of the Lower Eyelid

3.1.1 Anatomy of the Lower Eyelid and Orbit

The lower eyelid is organized into distinct lamellar layers that are important for both functional integrity and surgical planning. These layers separate the anterior from the posterior eyelid structures (2,4).

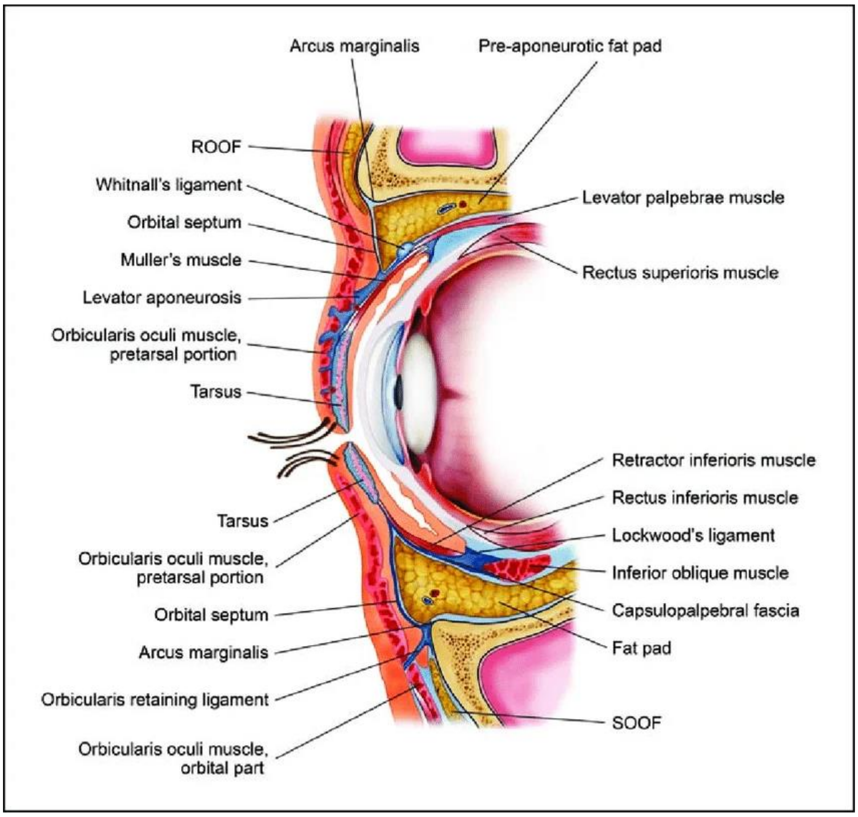

Fig 2. *Sagittal section of the orbit and lower eyelid. The illustration demonstrates the anatomical relationship between the anterior, middle, and posterior lamellae, including the orbicularis oculi muscle, orbital septum, tarsus,*

capsulopalpebral fascia, orbital fat, inferior oblique muscle, orbicularis retaining ligament, and sub-orbicularis oculi fat. Reproduced from Botti et al.(6) with permission from Oxford University Press, License No. 6260030967228.

For surgical purposes, the lower eyelid can be divided into anterior, middle, and posterior lamellae. The anterior lamella includes the skin and orbicularis oculi muscle, while the middle lamella is mainly represented by the orbital septum. The posterior lamella consists of the tarsal plate, lower eyelid retractors, and palpebral conjunctiva (2,4).

The lower eyelid skin is extremely thin, which makes it prone to laxity and postoperative contour changes and is therefore highly relevant during surgical planning (7). The tarsal plate provides the main structural support of the eyelid and contains the Meibomian glands, whose lipid secretion contributes to ocular surface stability (2,7).

Above the tarsal plate, the skin is closely attached to deeper tissues, whereas below the inferior tarsal border the skin becomes more mobile over the orbital septum. This loose attachment creates a potential plane where edema or post-traumatic fluid can collect (7).

The orbital septum separates the anterior eyelid structures from the orbital fat and is especially relevant during fat excision or repositioning. Inferiorly, the septum originates from the periosteum of the inferior orbital rim and inserts into the capsulopalpebral fascia just below the inferior tarsal border, thereby contributing to lower eyelid stability (7,8). In the lower eyelid, the orbital septum and lower eyelid retractors are not fused at a fixed level but join at variable distances below the tarsal plate. Reported distances are approximately 3.7 mm medially, 4.3 mm centrally at the level of the pupil, and up to 5.4 mm laterally (8).

The orbicularis oculi muscle is the main eyelid protractor and lies immediately beneath the eyelid skin. Functionally, it can be divided into pretarsal, preseptal, and orbital portions. The pretarsal and preseptal segments are mainly involved in spontaneous blinking and involuntary lid closure, whereas the orbital portion contributes more to voluntary and forceful eye closure (2,7). Preservation of the pretarsal orbicularis is clinically important because disruption of this segment may impair eyelid tone and increase the risk of postoperative malposition.

Motor innervation of the orbicularis oculi is supplied by terminal branches of the facial nerve (CN VII). The medial lower eyelid orbicularis usually receives branches from the buccal nerve, while the lateral portion is supplied mainly by the superior zygomatic branch Injury to these terminal branches can result in orbicularis weakness and impaired lower eyelid support (2,8).

Beyond the soft-tissue layers, the bony orbital framework is also relevant for lower eyelid position and surgical planning. The inferior orbital rim provides an important intraoperative reference during fat repositioning and assessment of the lid-cheek transition. Age-related changes in the relationship between soft tissue and the underlying skeleton contribute to periorbital hollowing and may become more visible over time.

3.1.2 Orbital Fat Compartments

The lower eyelid contains three retroseptal fat compartments: medial, central, and lateral. These compartments lie posterior to the orbital septum and are separated by distinct anatomical landmarks that are important during transconjunctival dissection (7). Each compartment is surrounded by a delicate fibrous envelope, allowing controlled mobilization during surgical dissection (2,4,7).

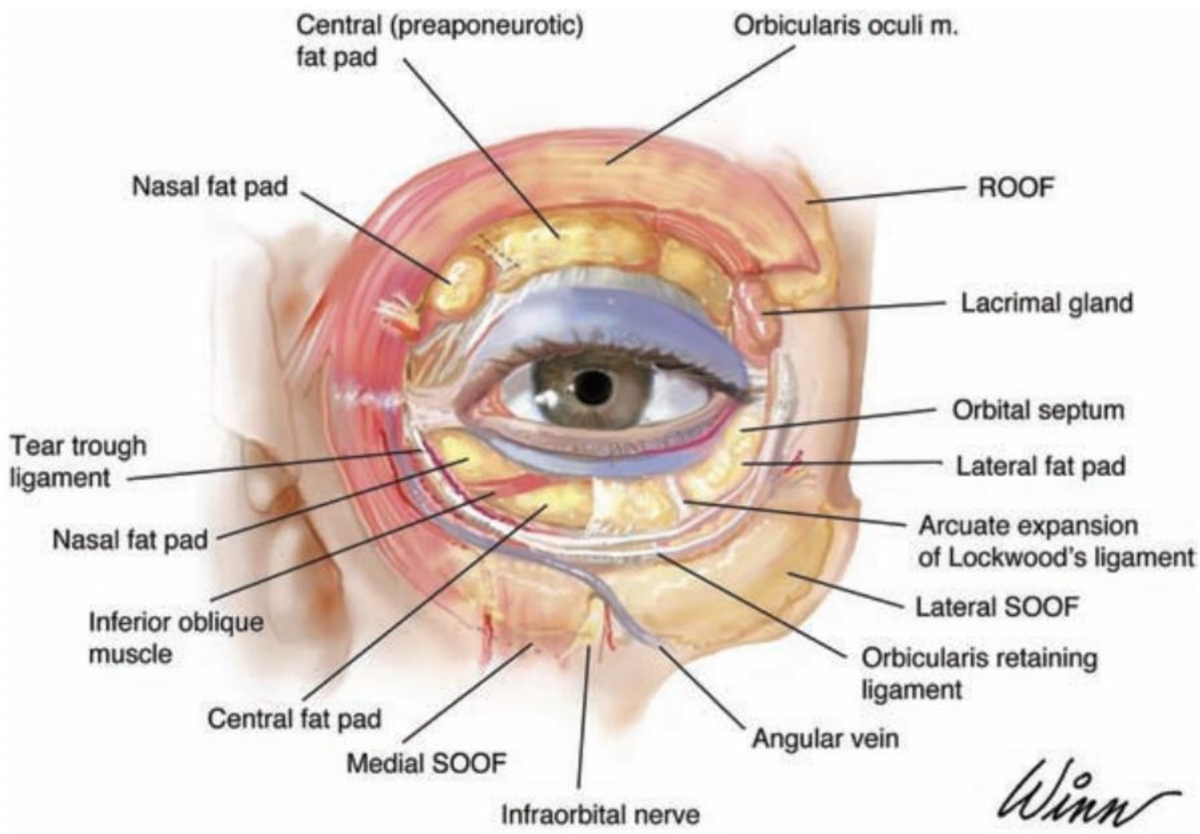

***Fig 3**. Transconjunctival view of lower eyelid anatomy showing the three postseptal fat compartments: medial, central, and lateral. The inferior oblique muscle separates the medial and central fat pads, while the arcuate expansion, also referred to as Clifford's ligament, separates the central and lateral compartments. The illustration demonstrates anatomical relationships relevant to transconjunctival lower eyelid blepharoplasty. Reproduced from Alghoul (9). With permission from Oxford University Press, License No. 6260011162367.*

The inferior oblique muscle is an important intraoperative landmark because it lies between the medial and central lower eyelid fat compartments. Careful identification of this muscle is clinically relevant, as injury during dissection may lead to postoperative diplopia or impaired extraocular movement (2,7,8).

The central and lateral fat compartments are separated by the arcuate expansion, also described as Clifford's ligament. This fibrous structure courses from the inferolateral orbital rim toward the medial canthal region and lies deep to the orbital septum but superficial to the inferior oblique muscle (2,8).

Laterally, the orbital septum inserts slightly outside the inferior orbital rim, creating the so-called recess of Eisner. This configuration may facilitate anterior prolapse of the lateral fat compartment and is therefore relevant during lower eyelid dissection(2).

Steatoblepharon refers to apparent protrusion of the orbital fat pads rather than a true increase in fat volume. It is mainly associated with age-related attenuation of the orbital septum and reduced containment of the orbital fat. Mild inferior globe descent may further increase pressure on the lower eyelid fat compartments. Clinically, these changes produce lower eyelid fullness and contribute to the double-convex contour typical of periorbital aging (2,4). Understanding this mechanism is important because it explains why modern lower eyelid blepharoplasty increasingly focuses on fat preservation, repositioning, and restoration of the lid-cheek transition rather than simple fat excision alone.

3.1.3 Anatomy of Lid-Cheek Junction and Midface

The lid-cheek junction, often described in relation to the infraorbital sulcus, marks the transition zone between the lower eyelid and the upper cheek. Rather than representing two completely separate regions, the lower eyelid and midface should be understood as a continuous anatomical and functional unit, because changes in eyelid support, orbital fat position, and midfacial soft tissue volume influence the same visible contour (10).

Clinically, this transition is shaped by three main surface landmarks. The inferior palpebral crease lies most superiorly and corresponds to the attachment of the lower eyelid retractors near the tarsal plate. Medially, the nasojugal groove is closely related to the tear trough region and is influenced by ligamentous and vascular structures. Laterally, the palpebromalar sulcus marks the transition toward the malar region and is affected by the contour of the inferior orbital rim (10).

With aging, the lid-cheek junction becomes more visible because the lower eyelid and cheek differ markedly in skin thickness, subcutaneous fat, and soft-tissue mobility. Lower eyelid skin is very thin and contains little subcutaneous tissue, especially medially, whereas the cheek has thicker skin and a more substantial fat layer (10). Progressive volume loss, fat redistribution, and soft-tissue descent can therefore make the infraorbital rim appear more skeletonized and deepen the transition between the eyelid and cheek. This has shifted the interpretation of periorbital aging away from a purely skin-based process toward a model that also emphasizes volume loss, ligamentous support, and midface position.

Several retaining structures contribute to this transition zone. The orbicularis retaining ligament runs along the inferior orbital rim and connects the orbicularis oculi region to the periosteum. Medially, it is closely related to the tear trough ligament, although the exact anatomical separation between these structures remains debated (10).

Deep to the orbicularis oculi muscle lies the sub-orbicularis oculi fat. This fat compartment is limited superiorly by the orbicularis retaining ligament and inferiorly by the zygomaticocutaneous ligament, and it contributes to midface fullness, volume distribution, and support of a smooth lid-cheek contour (8,10). Beneath the sub-orbicularis oculi fat lies the prezygomatic space, which is stabilized by surrounding retaining ligaments and represents an important surgical plane in lower eyelid and midface procedures (10,11).

With aging, differential tissue descent and ligamentous fixation contribute to the characteristic double-convex contour of the midface (2,4). This contour change represents an important target in aesthetic lower eyelid surgery.

Contemporary approaches increasingly emphasize fat preservation and transposition to restore volume and improve the lid-cheek transition (2,4). Downward repositioning of the septal fat may help camouflage the tear trough deformity, while reinforcement of the orbicularis retaining ligament can improve lower eyelid support. These anatomical insights have influenced contemporary surgical strategies, shifting the focus from simple tissue excision toward restoration of structural support and volume distribution within the lid-cheek unit (2,4,11).

3.1.4 Anatomical Relevance for Surgical Planning

The structural foundation for vertical eyelid stability is the tarsal plate, which typically has a central height of 4 mm to 5 mm. In contrast, horizontal support is predominantly provided by the medial and lateral canthal tendons, which anchor the eyelid to the orbital rim. The lateral canthal tendon is a major stabilizer, characterized by its 10 mm wide insertion at the level of Whitnall's tubercle on the lateral rim (7,10).

Determining the need for supportive interventions depends on a thorough preoperative assessment of horizontal eyelid laxity. Based on the results of distraction and snap-back tests, procedures like canthopexy or a lateral tarsal strip may be indicated to ensure adequate lid positioning. This tailored approach is essential to reduce the likelihood of postoperative complications, such as eyelid retraction or ectropion. Additionally, preserving the motor nerve supply to the orbicularis oculi is a vital surgical goal. Clinicians must be particularly cautious in the "danger zone", an area roughly 2.5 cm inferolateral to the lateral canthus, where terminal zygomatic nerve branches are vulnerable during dissection. Although its boundaries vary, this zone generally spans about 1 cm in diameter (2,4,10).

The choice between operative approaches is dictated by anatomical risk factors and patient presentation. Transconjunctival techniques are frequently chosen for patients with fat pseudoherniation but minimal skin excess, as they help avoid external scarring and lid malposition. Conversely, transcutaneous routes remain necessary when skin-muscle resection or midface procedures are planned (2). These preferences are based largely on retrospective data rather than high-level comparative evidence.

A key structure in modern blepharoplasty is the orbicularis retaining ligament (ORL), which forms a circumferential connection between the bony orbit and the overlying muscle. Selective division of the ORL allows for the mobilization of orbital fat beyond the infraorbital rim into the sub-orbicularis oculi fat (SOOF) compartment, facilitating a smoother transition between the lid and cheek. Lateral support also depends on the arcuate expansion (Clifford's ligament); excessive detachment of this structure without sufficient canthal support can elevate the risk of ectropion or retraction. Consequently, ligamentous release should be performed conservatively and only when necessary. In subperiosteal fat transposition cases, careful dissection is mandatory to avoid sensory deficits resulting from trauma to the infraorbital neurovascular bundle (2).

Furthermore, the orbital vector is a critical consideration in surgical planning. Patients with a negative vector often benefit from volume-preserving or augmenting strategies rather than aggressive fat excision to prevent a "skeletonized" appearance. Finally, the relationship between the septum and the orbital rim evolves with age due to bone remodeling. The orbital septum converges with the capsulopalpebral fascia below the tarsal plate's inferior margin. Modern techniques may incorporate a "septal reset" to improve contour stability and address tear trough deformities (2,4).

3.1.5 Ethnic Variability and Implications for Surgical Technique

Ethnic differences in skeletal anatomy and soft-tissue characteristics have been reported to influence lower eyelid aging and may be relevant during surgical planning. Several comparative studies involving Caucasian and Asian cohorts have described different patterns of bony remodeling. While some Caucasian populations appear to show progressive enlargement of the orbital aperture with age, some Asian cohorts have been reported to exhibit less pronounced orbital expansion (12). In contrast, anterior maxillary resorption may be more pronounced in certain Asian populations. Sex-specific differences have also been described, although findings vary across studies. These observations should be interpreted with caution, as many are derived from population-specific imaging studies and may not be generalizable to all patient groups (13). Changes in the midface skeleton are further reflected by a deepening of the canine fossa and more pronounced resorption of the superior orbital rim compared to the inferior rim in certain Asian populations (14). Beyond skeletal differences, variations in soft-tissue characteristics may also influence aesthetic goals and surgical outcomes. Some studies have reported thicker skin and a higher tendency toward hypertrophic scarring or post-inflammatory hyperpigmentation in Asian cohorts, although these findings are not uniform across all populations and study designs (15). Moreover, pretarsal fullness may be perceived as a youthful aesthetic feature in some patients and may therefore be intentionally preserved depending on individual preferences (16). Anatomical differences, such as variation in the fusion point between the orbital septum and the levator aponeurosis, may also influence fat position and surgical planning (15). These anatomical and physiological differences may also influence procedure-specific risks and may require modification of standard techniques. External skin incisions, particularly when combined with laser resurfacing, have been associated in some studies with a higher risk of hypertrophic scarring and dyspigmentation in selected patient groups (3,15,17). For this reason, the transconjunctival approach may be preferred in some patients, particularly those at increased risk of visible scarring. Excessive elevation of the eyelid crease should be avoided to reduce the risk of an unnatural or overcorrected appearance and to minimize functional complications such as asymmetry or ptosis (15). Beyond surgical considerations, adjunctive treatments may be required to address pigmentation-related concerns, such as periorbital melasma or dark circles, for which topical therapies may be used as supportive treatment (3).

Recent studies have focused specifically on Asian cohorts, highlighting the importance of population-specific approaches. Huang et al. described a refined transcutaneous technique combined with micro-autologous fat transplantation in a large Taiwanese cohort, while other studies have explored deep-learning models based on imaging datasets to characterize age-related changes in the Asian orbit, although the direct clinical applicability of these approaches remains limited (13,14,16).

These findings highlight the importance of individualized treatment planning and suggest that lower eyelid blepharoplasty techniques should not be applied without considering anatomical and aesthetic variability across patient populations.

3.2 Aging Process and Periorbital Changes

3.2.1 Skeletal Changes

The aging of the facial skeleton is typically described as a gradual and region-specific remodeling process. A primary hallmark of periorbital aging is the steady expansion of the bony orbit. Radiological assessments, particularly those employing CT-based morphometry, confirm that the orbital aperture undergoes measurable enlargement over time; reports indicate a mean increase of roughly 15% to 20% by the seventh decade of life. Specific morphometric studies have quantified these changes as an approximate vertical height increase of 2.3 mm and a horizontal width expansion of 1.8 mm per decade (10,12,14).

Regional differences in bone resorption have been described. In some Asian cohorts, remodeling appears more pronounced along the superior orbital rim than along the inferior rim. Sex-related differences have also been reported, with women showing greater orbital changes and men more pronounced mandibular remodeling, although these findings vary between studies and should be interpreted with caution (12–14).

The structural evolution of the infraorbital rim is a major factor in the aged appearance of the midface. Patterns of bone loss appear to vary by sex; whereas males often experience resorption across the entire rim, females typically demonstrate resorption primarily in the lateral segment. Based on the concepts popularized by Lambros, the aging process in this region correlates with a posterior shift of the maxilla and a lateral displacement of the lower orbital margin (10). This shift disrupts the nearly 90-degree angle between the orbital rim and the septum observed in youth, which can predispose the patient to the pseudo-herniation of orbital fat. Such maxillary retrusion leads to decreased projection of the midface and reduced structural support for the overlying soft tissues, which clinically deepens facial grooves (10,12,14).

The term 'orbital vector' describes the spatial relationship between the globe and the midfacial skeleton. A 'negative vector' configuration, where the corneal apex is positioned anterior to the infraorbital rim, is closely linked to an elevated risk of postoperative eyelid malposition (3,4). For surgical planning, identified negative vector anatomy necessitates a restorative strategy focused on volume preservation, repositioning, or midfacial augmentation, rather than aggressive tissue resection(2,18).

3.2.2 Fat Changes

The age-related changes in periorbital and midfacial adipose tissue are closely linked to the development of contour irregularities along the lower lid and the transition zone to the cheek. As the orbital septum weakens with age, it allows forward protrusion of orbital fat; this phenomenon, known as pseudoherniation, is clinically recognized as the formation of lower eyelid "bags" (3,4). Conversely, while orbital fat may appear more prominent, the deeper midfacial fat compartments lose volume with age. Specifically, the sub-orbicularis oculi fat (SOOF) undergoes steady atrophy and a downward displacement. These changes are main causes of the deepening of infraorbital hollows and the increased definition of the lid-cheek junction (3,10,18).

Furthermore, the superficial malar fat pad typically migrates inferiorly as part of the aging process. The combination of superior fat protrusion from the orbit and volume loss in the lower midface results in the "double-convex" contour that characterizes the aged appearance of the central face (2,18).

The appearance is further worsened by the interplay between herniated fat pads and the descending malar tissues, which often creates a visible shadowing effect. When these structural shifts occur alongside the thinning of the lower eyelid dermis, they can exacerbate the clinical appearance of periorbital dark circles (3,10,18).

3.2.3 Ligamentous Influence

During youth, the transition between the eyelid and cheek is smooth, characterized by a continuous transition between the lower lid and the adjacent malar region. With aging, ligamentous tethering becomes more visible as a result of fat redistribution and the descent of soft tissues (10,18). These structural shifts produce a more visible demarcation at the lid-cheek junction and the development of characteristic shadowing in this region (4,18). The orbicularis retaining ligament (ORL) acts as a stabilizing structure linked to the visible demarcation of the lid-cheek junction. Medially, the attachment of the ORL is particularly dense and is frequently identified as the tear trough ligament (TTL). This firm bony attachment can worsen the appearance of tear trough hollowing as age-related tissue thinning and fat pseudoherniation progress (10,18).

Complementing this, the zygomaticocutaneous ligament (ZCL) contributes to the midfacial support network and the compartmentalization of deep tissue layers. Specifically, the ZCL delineates the inferior boundary of the sub-orbicularis oculi fat (SOOF), whereas the ORL constitutes its superior boundary (3,10). Within the medial periorbital zone, the ORL and ZCL merge, creating a site where the orbicularis oculi possesses a direct attachment to the underlying periosteum (10).

3.2.4 Skin and Soft Tissue Changes

Dermatochalasis is a characteristic feature of lower eyelid aging, manifesting as excess skin and skin laxity (2,4). Clinicians typically assess this condition preoperatively by observing the skin while the patient opens their mouth or gazes upward; the surgeon estimates the amount of skin to determine safe limits for excision (4). In cases where notable cutaneous excess is present, a transcutaneous route is generally favored, as the transconjunctival approach does not provide direct access to the redundant anterior lamella (2,3).

Acknowledging that the lower lid is covered by some of the thinnest skin in the body, periorbital aging is frequently characterized by further skin thinning and loss of subcutaneous fat, especially in the medial region (3,10,18). This transition makes the underlying orbicularis oculi muscle more perceptible through the now nearly transparent dermis (10). Greater visibility of the underlying vascular plexus may contribute to bluish discoloration. Together, these changes are associated with the characteristic darkening of the lower eyelid region (10).

Another critical feature of lower eyelid aging is the progressive loss of skin elasticity (18). This is accompanied by a reduction in dermal thickness and subcutaneous volume (18). These changes are associated with skin laxity and the development of fine wrinkles or crepey texture (2,3). Loss of elastic support may contribute to fat redistribution and accentuate the lid-cheek junction (10).

The Tyndall effect describes the bluish appearance of dark circles beneath the eyes (3). The etiology of dark circles is multifactorial and includes vascular, structural, and pigmentary components (10,19). It is thought to result from light scattering through thin lower eyelid skin overlying darker subcutaneous structures (10). Clinically, dark circles are most prominent in the region of the nasojugal groove, or tear trough (10). With aging, their appearance may be further accentuated by shadowing caused by pseudoherniation of orbital fat (3,10). True dermal pigmentation may also be present and may, in some cases, be addressed with skin resurfacing techniques such as chemical peels or laser treatment (3).

3.3 Epidemiology and Indications of Lower Eyelid Blepharoplasty

3.3.1 Epidemiology

Lower eyelid blepharoplasty is among the most frequently performed aesthetic procedures (2,19). According to the American Society of Plastic Surgeons (ASPS), 120,755 blepharoplasty procedures were performed in 2024, compared with 120,747 in 2023, indicating stable procedural numbers over this period (19).

The largest proportion of patients belongs to the baby boomer age group (55–69 years), accounting for 56% of procedures. Patients aged 40–54 years represent 25% of procedures, while individuals aged 70 years and older account for 16% of the total volume (19). Overall, blepharoplasty is most performed in patients older than 40 years. The onset of periorbital aging varies across populations. In some Caucasian populations, the first signs of tear trough deformity have been reported between 38 and 45 years of age, whereas in some Indian populations these changes may occur earlier, often between 35 and 40 years (2). Skeletal aging patterns, such as the enlargement of the orbital aperture, can be detected as early as the fourth decade (12).

Women remain the predominant patient group, accounting for 87% of all blepharoplasty procedures (105,404 procedures), whereas men represent 13% (15,351 procedures) (19). Although the number of procedures in men slightly decreased in 2024, long-term interest among male patients appears to be increasing (19). Some studies have suggested that women may experience more pronounced orbital changes than men, which may partly contribute to the higher procedural volume observed in women (12).

Demand for periorbital rejuvenation has increased steadily over the last decade (2,4). This trend has been attributed to demographic aging, growing awareness of aesthetic procedures, and continued refinement of surgical techniques (4,19). Epidemiological data are largely derived from national databases such as the ASPS, which may therefore not fully reflect global practice patterns.

3.3.2 Indications for Lower Eyelid Blepharoplasty

Indications for lower blepharoplasty are predominantly aesthetic and arise from age-related anatomical changes. The most common indications include dermatochalasis, steatoblepharon, tear trough deformity, and a prominent transition at the lid-cheek junction. Steatoblepharon refers to pseudoherniation of orbital fat and contributes to the lower eyelid fullness. Relevant anatomical risk factors such as negative vector anatomy along with lower eyelid laxity should be considered, as they are associated with an increased risk of postoperative complications (3,4). The indication for surgery is not based on a single anatomical feature but rather on the overall assessment of lower eyelid morphology, including the relationship between fat prolapse, skin laxity, and midface volume loss. In many cases, a combination of these factors is present together clinically. Indications for lower eyelid blepharoplasty are often based on subjective aesthetic assessment rather than standardized criteria, which may lead to variability in clinical decision-making.

3.3.3 Preoperative Assessment and Risk Factors

A structured preoperative assessment typically includes evaluation of lower eyelid position and symmetry. This involves inspection of the eyelid margin, assessment of tear trough or lid-cheek junction deformities, and classification of skin type using the Fitzpatrick scale (3).

The orbital vector should also be assessed, as a negative vector is associated with increased risk of postoperative lower lid malposition (3,4,18).

The preoperative assessment should also include evaluation of patient expectations. Unrealistic expectations or signs of body dysmorphic disorder may negatively influence postoperative satisfaction and outcomes, although these associations are often based on observational data (15,19).

Lower eyelid laxity is commonly assessed using clinical tests such as the snap-back and distraction tests. Delayed return of the eyelid or increased anterior displacement may indicate horizontal laxity and may suggest the need for canthal support procedures (3,4,18). During the distraction test, the eyelid is pulled anteriorly away from the globe. A distance of more than 6 mm may suggest horizontal laxity, although thresholds vary across studies (1,4,20). The skin pinch test can be used to estimate the amount of redundant skin that can be safely resected without increasing the risk of postoperative lid retraction (1,20).

To determine globe position, Hertel exophthalmometry is used to assess globe position relative to the lateral orbital rim. Values greater than approximately 18 mm may suggest increased globe prominence, although values must be interpreted in relation to individual and population-specific norms (18).

Assessment of medical risk factors is an important component of preoperative planning to minimize postoperative complications in lower eyelid blepharoplasty. Preexisting dry eye symptoms should be carefully assessed, as they have been associated with an increased risk of postoperative complications (1). Smoking is a risk factor and is associated with tear film instability and impaired wound healing (4,8).

Perioperative management of anticoagulant and antiplatelet therapy, as well as agents that may affect coagulation such as NSAIDs, vitamin E, along with herbal supplements such as ginkgo biloba, should be carefully reviewed to reduce the risk of bleeding and retrobulbar hemorrhage (3,4). Lower eyelid blepharoplasty is commonly deferred for several months following corneal refractive surgery, depending on ocular surface stability (1,4).

3.4 Surgical Techniques

The following descriptions summarize commonly reported operative principles from the reviewed literature and are not intended to represent a standardized surgical protocol. Surgical planning in lower eyelid blepharoplasty is commonly based on the dominant anatomical problem, including the presence of excess skin, orbicularis laxity, tear trough deformity, eyelid vector, lid distraction, and fine rhytids. An algorithmic approach illustrates how these variables guide the choice between transconjunctival access, transcutaneous skin-muscle flap techniques, fat transposition, conservative fat excision, canthal support, skin pinch, and resurfacing procedures.

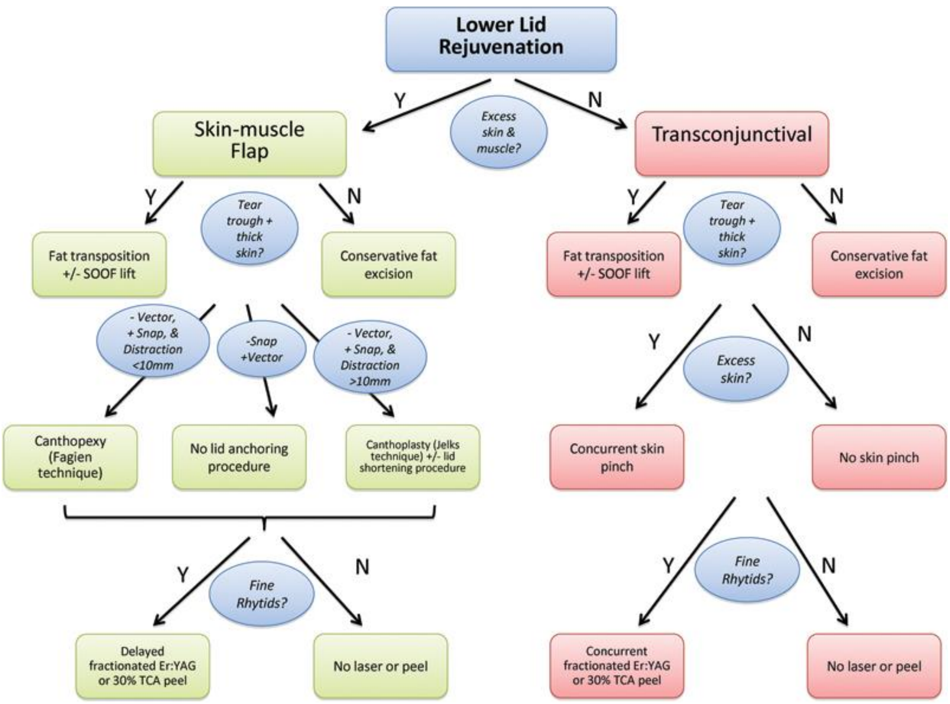

Fig 4. *Decision-making algorithm for lower eyelid rejuvenation. This schematic outlines the clinical criteria used to select between transcutaneous skin-muscle flap and transconjunctival approaches, highlighting key preoperative variables such as anterior lamellar redundancy, severity of the lid-cheek junction deformity, baseline eyelid tone, eyelid vector, lid distraction, and fine rhytids. Reproduced from Collar et al.(18) with permission from Georg Thieme Verlag KG, License No. 6260040695932.*

3.4.1 Transconjunctival Approach

3.4.1.1 Overview, Indications, and Contraindications

The transconjunctival approach provides access to the orbital fat through an internal conjunctival incision, thereby avoiding a visible external scar. It is commonly indicated in patients with fat prolapse without significant skin excess. Two main variations are described: the preseptal and postseptal approaches.

Key indications include isolated fat prominence and tear trough deformity (2,3,21). The transconjunctival approach is often preferred in patients with good skin elasticity, as it may reduce the risk of postoperative eyelid retraction or iatrogenic ectropion and in selected patients with mild to moderate skin redundancy, it may be combined with a skin pinch or laser resurfacing (3,18,21).

Relative contraindications include notable skin excess, orbicularis muscle hypertrophy, and severe horizontal eyelid laxity, in which cases a transcutaneous approach may be preferred (3,4,18,21).

Additional relative contraindications include very thin skin and cases requiring extensive fat repositioning, where contour irregularities may be more visible (18). A distraction distance greater than 6 mm may suggest significant horizontal laxity, in which case the transconjunctival approach alone may be insufficient (3,20). Active eyelid inflammation, untreated dry eye disease, and uncontrolled systemic conditions represent further contraindications (3). Perioperative factors such as anticoagulant therapy and smoking should also be optimized to reduce complication risk. Cosmetic periorbital surgery is commonly deferred for at least six months after corneal refractive procedures such as Laser-Assisted in Situ Keratomileusis (LASIK) (3).

3.4.1.2 Surgical Approach

The procedure is typically performed using standard oculoplastic instruments (2,21–23). The patient is usually positioned with slight head elevation to reduce bleeding (21,24).

Before incision, adequate corneal protection and local anesthesia are considered essential. The cornea is typically protected with a metallic eye shield after application of topical anesthetic drops (4,15,21). Infiltration of local anesthesia containing epinephrine typically targets the lower lid, inferior fornix, and the lateral canthus, and an infraorbital nerve block may be added when deeper fat manipulation is planned (1,21,22,24). Following lower lid eversion, a transverse incision is made through the conjunctiva and lower eyelid retractors approximately 3-6 mm below the inferior tarsal plate (3,24). Two principal variations are described; in the preseptal approach, surgical planes are developed in front of the orbital septum, whereas in the postseptal approach, entry through the conjunctiva allows for immediate exposure of post-septal fat depots. This preseptal approach is often preferred for aesthetic fat reduction or transposition (1,21).

Once the surgical plane has been established, applying light globe compression often helps exteriorize and distinguish the three primary fat compartments. At this stage, several anatomical landmarks are particularly important. Identification and protection of the inferior oblique muscle are paramount (2,3,10,22). The arcus marginalis is another important landmark, especially when fat repositioning is planned, as it must be released to allow transposition of fat beyond the infraorbital rim. The capsulopalpebral fascia should be recognized because of its close relationship with the eyelid retractors and the orbital septum (8,10).

Fat management may involve either conservative excision or repositioning, depending on the anatomical findings and surgical goal. If fat excision is performed, it should remain conservative, as over-resection may result in a hollowed or cadaveric appearance (1,2,4,21,22).

Meticulous hemostasis is essential throughout the procedure, particularly for the prevention of retrobulbar hematoma, which remains an uncommon but vision-jeopardizing event (2,22). To safeguard the lacrimal apparatus, the surgical opening must remain far enough lateral to the punctal area. Attention should also be paid to the so-called critical zone in the lateral infraorbital region, where motor branches to the orbicularis muscle may be vulnerable during more extensive dissection (17,21). Upon completion of the surgery, the conjunctival opening is frequently left unsutured, as it usually heals spontaneously after repositioning of the lid (1,24). In selected cases, a single absorbable suture may be placed medially to improve alignment and avoid tissue overlap (21). Depending on the individual case, the transconjunctival technique may be combined with additional adjunctive measures, including laser skin treatment or canthopexy, to improve the functional support and visual outcomes.

Figure 5 illustrates a transconjunctival approach with conjunctival incision, exposure of orbital fat, fat excision, and conjunctival closure.

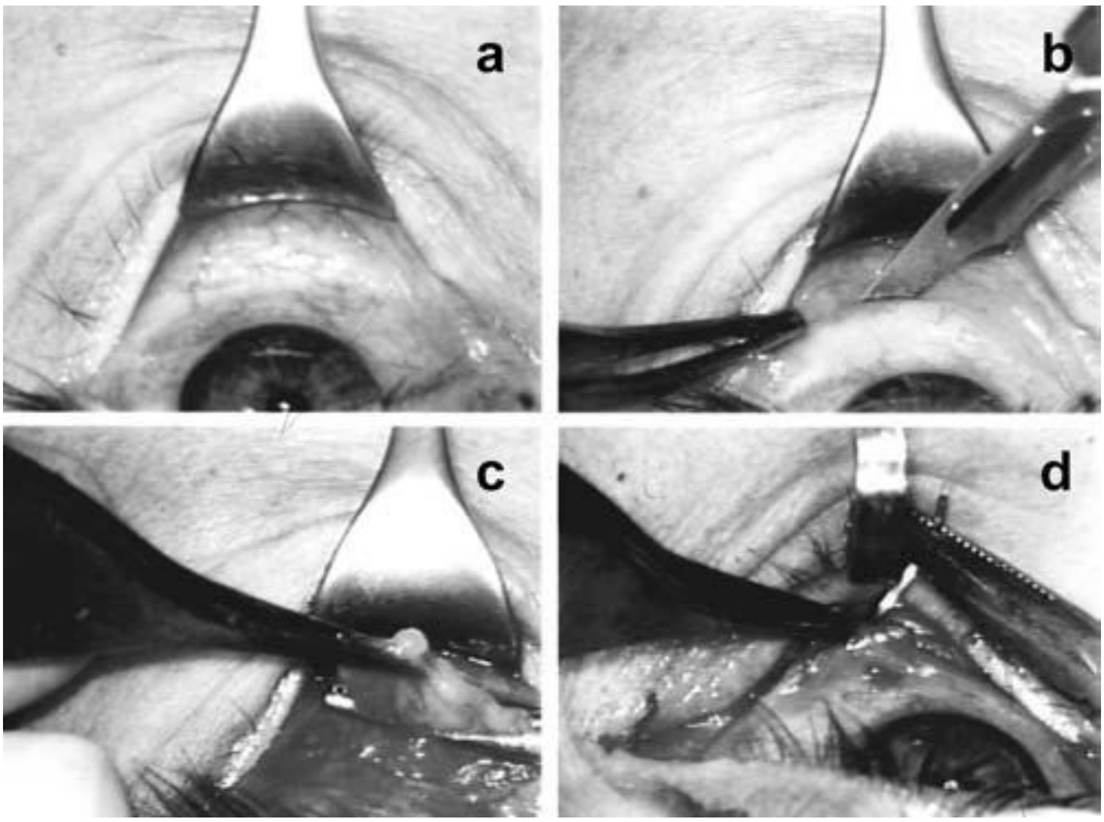

Fig 5 . *Transconjunctival lower blepharoplasty: The figure shows the preseptal and retroseptal transconjunctival approaches and the operative sequence including lower eyelid retraction, conjunctival incision, fat excision, and conjunctival suture. Reproduced from Korchia et al.(21). Permission status: non-commercial educational reuse according to the publisher's current copyright policy.*

3.4.1.3 Clinical Outcome and Synthesis

The transconjunctival approach is considered a dependable and proven technique, especially in individuals presenting with isolated fat prolapse (steatoblepharon) without significant skin excess (2,21). Since the integrity of the eyelid's anterior lamellar unit, consisting primarily of the cutaneous and muscular layers, remains largely preserved during this procedure, potential risk of iatrogenic complications may be reduced. In the cited comparative data, lower eyelid retraction was reported in 0% of patients after the internal transconjunctival method, in contrast with 15% up to 20% after the traditional external route; ectropion was also reported to be rare after transconjunctival blepharoplasty (21). Regarding aesthetic outcomes, the literature generally reports high success and satisfaction rates. An evaluation of 540 patients over a period of 18 years demonstrated that, particularly in combination with the transposition of fat, the transconjunctival method can contribute toward a harmonious and smooth gradient across the lid-malar junction, which is referred to as the specific lid-cheek junction, without pronounced scarring or contour deformities such as festoons (2). Clinical studies show a patient satisfaction rate of over 94% (24). Despite its favorable safety profile, the transconjunctival approach is not without limitations and postoperative complications. The most common aesthetic limitation is undercorrection, including so-called remnant bags due to insufficient fat reduction or repositioning. This has been reported in approximately 2.7% to 8.7% of cases and may occasionally require a secondary procedure (2,21). The most common transient complications in the early postoperative phase include conjunctival redness or chemosis, mild bruising or ecchymosis, and swelling, which usually subside within a few weeks with conservative measures such as cooling (24).

3.4.2 Transcutaneous Approach

3.4.2.1 Overview

The transcutaneous approach is a well-established technique used for the management of lower eyelid aging in patients with significant skin redundancy and muscle laxity. This method provides direct access across the anterior lamellar layer and post-septal fat compartments while being therefore particularly suitable for combined skin, muscle, and fat correction (22).

3.4.2.2 Surgical Approach

The incision is typically placed in the subciliary region, approximately 1 to 2 below the lash line (22). The main steps of transcutaneous approach are illustrated in Fig. 6 and include a subciliary incision, skin-muscle flap elevation, orbitomalar ligament release, inferior opening of the septal layer, and subsequent adipose transposition.

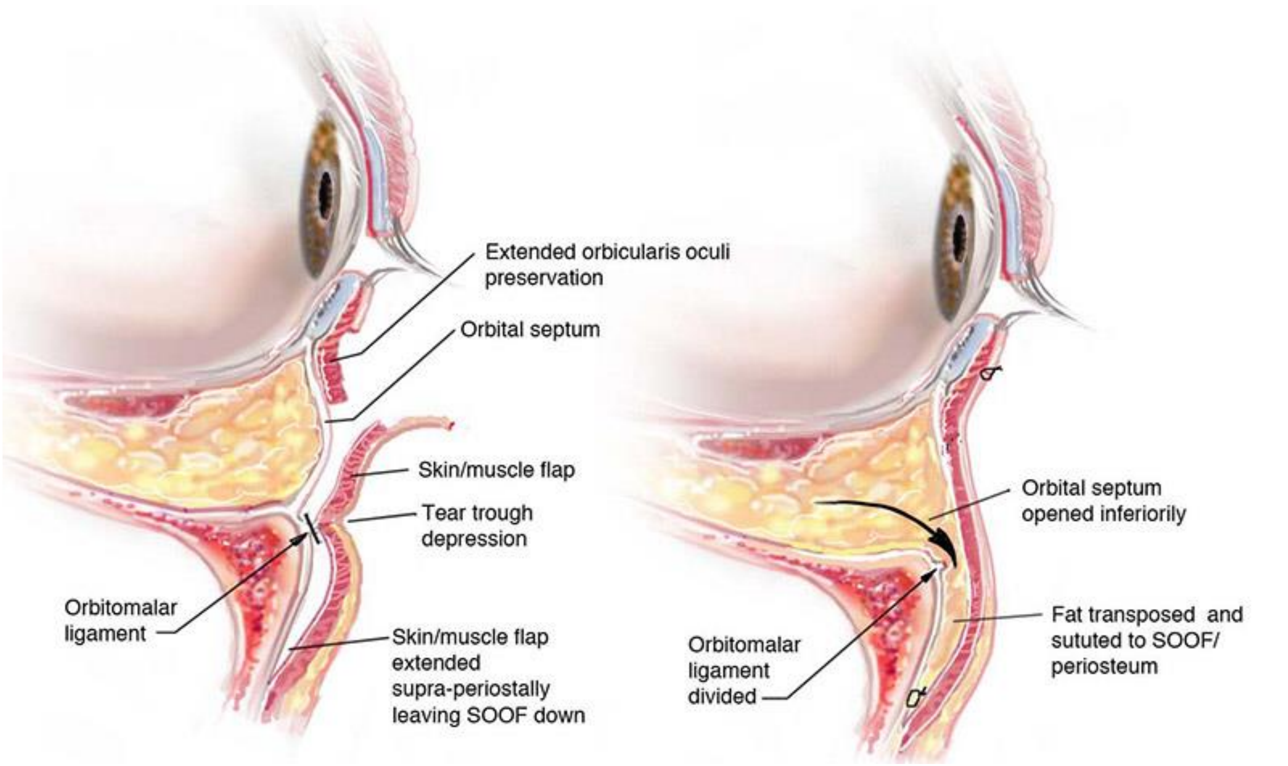

Fig 6*. Lower lid correction via a transcutaneous route with skin-muscle flap elevation and orbital fat transposition: The illustration shows the subciliary entry point, lifting of the skin-muscle unit, release of the orbitomalar ligament, inferior septal incision, and repositioning of fat depots toward the SOOF/periosteum. Adapted from New York Facial Plastic Surgery (25).*

Depending on the clinical indication, two main techniques have been described: The Castanares skin flap involves elevation of the cutaneous layer independently from the subjacent orbicularis oculi muscle, primarily indicated for individuals presenting with redundant skin but functional muscle tone (1,4,22). In contrast, the McIndoe–Beare skin-muscle flap includes the orbicularis oculi muscle, with dissection performed in a plane beneath the muscular layer but anterior to the orbital septum, identifying the preseptal plane (4,18,22,26). The dissection is then extended inferiorly towards the infraorbital rim (1,26). In the transcutaneous approach, dissection may utilize either a preseptal or a submuscular dissection plane, depending on the surgical technique (18,20,22). Incising the orbital septum reveals the underlying fat compartments (4,22,26).

Precise identification of anatomical structures is critical during the transcutaneous approach to avoid intraoperative complications. The orbital septum serves as an important landmark, while the postseptal fat is categorized into medial, central, and lateral depots (2,15,22). The arcus marginalis, which serves as the anchor for the orbital septum at the level of the infraorbital rim, plays a key role in fat repositioning techniques (1,3,18,22).

Management of orbital fat depends on the surgical concept and patient-specific anatomy. Traditionally, treatment has focused on excision of protruding orbital fat. Resection is generally performed conservatively to avoid a hollowed appearance (2,4,22).

Throughout the procedure, careful attention must be paid to intraoperative safety. Adequate hemostasis is essential to prevent complications such as retrobulbar hemorrhage, a rare but potentially sight-threatening emergency (2,4,15,22). Particular care must be taken regarding the lateral infraorbital 'critical zone', as traumatizing motor nerve fibers can compromise eyelid motility and lead to subsequent lower eyelid malposition (2,8). Maintaining the integrity of the orbicularis oculi muscle along with its nerve supply is therefore important for maintaining normal eyelid closure and tear film dynamics (20,22).

To conclude the operation, the skin incision is typically closed with fine suturing material (1,22,26,27). Adjunctive procedures may be required based on individual anatomical findings to optimize both functional and aesthetic outcomes. These may include procedures such as lateral canthoplasty or canthopexy, based on the severity of lid laxity, to improve lower eyelid stability, especially for individuals with a negative vector or laxity (2,20,22,27). Elevation of the sub-orbicularis oculi fat (SOOF) may be performed to restore midface volume, while autologous fat transplantation may be used to further refine the contour across the nasojugal groove and lid-cheek junction (3,18,20).

3.4.2.3 Clinical Outcome and Synthesis

Unlike the internal transconjunctival route, the transcutaneous method offers broader exposure, allowing not only resection or repositioning of orbital fat, but also repositioning of the anterior lamellar layer as well as the midface (24). Clinical data indicate that patient satisfaction rates are very high. Studies including patient cohorts report significant aesthetic improvement of the nasojugal groove and lid-cheek transition, featuring an improvement rate reaching 94% (24). A primary clinical challenge of the transcutaneous approach is postoperative lower eyelid malposition, including scleral show, lid retraction, scarring, and ectropion. Since this approach involves access through the anterior lamella and separation of the orbital septum, the risk of such malpositions has been reported to be approximately 15% to 20% in some studies (24). Recent modified transcutaneous techniques appear to reduce the risk of manifest ectropion when lid-protective measures, including lateral canthoplasty or canthopexy along with preservation of the pretarsal muscle segment, are used. However, reported rates vary between studies and should be interpreted in relation to patient selection and surgical technique (24).

3.4.3 Fat Repositioning and Arcus Marginalis Release

Fat repositioning and arcus marginalis release are used to address lower eyelid fullness when pseudoherniated orbital fat is accompanied by tear trough hollowing or lid-cheek junction depression. Instead of simply excising orbital fat, these techniques aim to redistribute volume across the infraorbital rim and restore a smoother transition between the lower eyelid and midface. The indication depends on the presence of tear trough deformity, herniated lid fat, skin excess, and the degree of lower eyelid laxity.

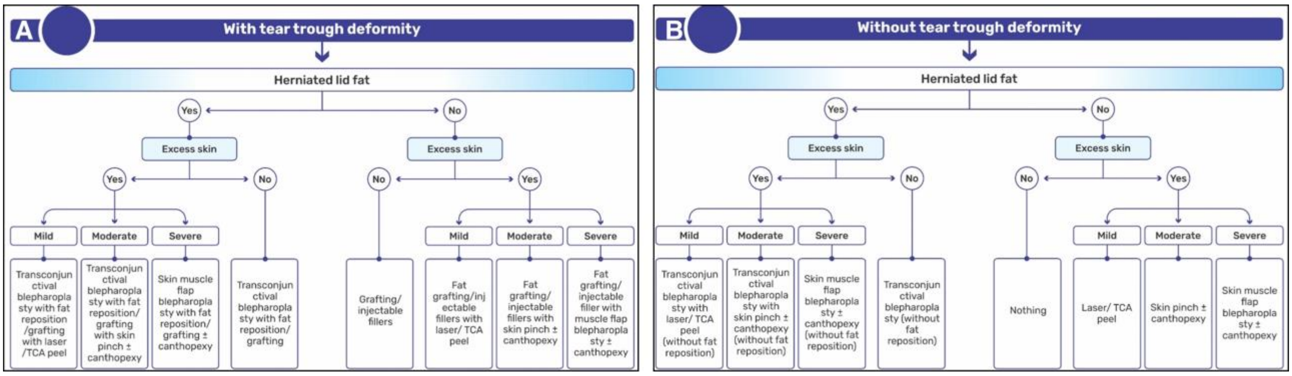

Fig 7. *Algorithm for lower eyelid blepharoplasty according to tear trough deformity, herniated orbital fat, and skin excess. The pathway illustrates how these anatomical findings guide selection between transconjunctival blepharoplasty, skin-muscle flap blepharoplasty, fat repositioning, grafting or fillers, adjunctive skin treatment, and canthal support. Reproduced from Nahai et al. (3) with permission from Oxford University Press, License No. 6260021297197.*

3.4.3.1 Overview, Indications, and Contraindications

The growing preference for fat transposition over traditional excision highlights an evolving paradigm in periorbital surgery. Rather than simply removing tissue, contemporary techniques prioritize the redistribution of existing orbital fat to correct volume deficits and achieve a natural, youthful contour (2,27,28). Several studies have described potential long-term disadvantages of aggressive fat removal, including infraorbital hollowing, increased skeletal show, and, in selected patients, lower eyelid retraction or vertical shortening (22,29,30). These concerns have contributed to growing interest in techniques that preserve and redistribute orbital fat rather than simply excising it (2,3,21).

Contemporary techniques frequently use the patient's herniated orbital fat as a vascularized filler to improve infraorbital contour (28). Because periorbital aging is often associated with relative volume loss as well as fat prominence, repositioning may help restore a smoother contour spanning the lower lid and midface (2,27). Transposition of fat into the medial hollowing of the tear trough may reduce contour discontinuity while preserving vascular attachment of the fat pedicle (1,2,22,29,31). Some authors suggest that this may offer more stable correction than free fat grafting, although comparative evidence remains limited (28,29).

In many fat-repositioning techniques, surgical liberation of the arcus marginalis constitutes an important operative step (18,22). This ligamentous band represents the anatomical site where the septum anchors to the inferior orbital margin. Releasing this structure may reduce the tethering effect contributing to nasojugal depression as well as may facilitate mobilization of post-septal adipose tissue across the orbital rim. Furthermore, arcus marginalis release enables the creation of subperiosteal or supraperiosteal pockets in the premaxillary or prezygomatic regions, which serve as recipient sites for the repositioned fat (2,18,30,31). The mobilized fat is then fashioned into vascularized pedicles and advanced into the prepared pockets (1,2,29). Preservation of the vascular supply is a critical advantage of this technique, as it contributes to improved long-term viability compared to free fat grafting. Fixation of the transposed fat can be achieved using internal absorbable sutures or temporary externalized sutures, according to surgeon preference, to maintain the desired position during the healing process (1,2,18,30).

Overall, the combination of arcus marginalis release and fat repositioning is a key component of contemporary lower eyelid blepharoplasty, enabling a shift from simple volume reduction toward anatomical restoration and more natural aesthetic outcomes.

Indications for fat repositioning are based on a tissue-preserving approach to lower eyelid rejuvenation. The technique may be particularly useful in patients with tear trough deformity, infraorbital hollowing, or the characteristic double-convex contour created by fat prominence above an area of volume deficiency. It may also be considered in patients with steatoblepharon associated with adjacent hollowing, in those with negative vector anatomy where aggressive fat excision may increase the risk of hollowing or malposition, and in selected secondary cases following previous over resection (1,2,24,28,30,32).

Fat repositioning is indicated in patients with signs of midface volume loss or global periorbital deflation. Aging of the lower eyelid region is frequently characterized by a contour imbalance, with infraorbital fat prominence and adjacent volume deficiency. This results in a so-called “double-convex deformity,” where bulging fat pads are separated from the malar region by a pronounced sulcus (1,4,22,32). By advancing the fat into this area of deficiency, a more continuous and harmonious lid-cheek contour can be achieved (2).

Patients presenting with steatoblepharon in combination with adjacent hollowing represent another key indication (2,24,28). In these cases, fat repositioning allows for redistribution of volume rather than removal, thereby avoiding an overcorrected or hollow appearance (1,29,31). This is particularly relevant in individuals with a negative vector, where the infraorbital rim lies posterior to the globe. In such patients, aggressive fat excision may increase the risk of lower eyelid malposition, whereas fat preservation and repositioning may provide structural support to the lower lid (1,2,4,27).

Furthermore, fat repositioning can be used in secondary procedures to correct contour irregularities following previous blepharoplasty, especially in cases of over resection leading to hollowing (16,21,29,30). It may also be beneficial in patients with malar hypoplasia, where repositioned fat contributes to augmentation of the midface and improvement of overall facial balance (2).

Despite its potential advantages, fat repositioning has several limitations. Compared with simple fat excision, it is technically more demanding and generally requires more extensive dissection and a detailed understanding of periorbital anatomy. Reported postoperative issues include transient contour irregularities, induration, edema, and ecchymosis. In addition, the available volume of orbital fat may be insufficient for complete correction in some patients, and partial resorption may occur if vascular supply is compromised. Rare but important complications include diplopia related to inferior oblique injury and sensory disturbance associated with infraorbital nerve traction or injury (1,24,32). Another limitation relates to volume distribution and long-term viability of the repositioned fat. Postoperatively, fat repositioning may be associated with more prolonged edema and ecchymosis than simpler techniques (1,4,8,17).

3.4.3.2 Surgical Approach

Fat repositioning in lower eyelid blepharoplasty is used to correct the combined problem of infraorbital fullness and adjacent volume deficiency. Instead of simply removing protruding orbital fat, the technique aims to redistribute vascularized fat into areas of hollowing, particularly along the tear trough and lid-cheek junction. Depending on the patient’s anatomy and the surgeon’s preference, fat repositioning can be performed through either a transconjunctival or a transcutaneous route (3,4). When a transconjunctival route is chosen, access is gained from the posterior lamella, usually through an incision placed a few millimeters below the inferior tarsal border. Dissection is then directed toward the infraorbital rim while avoiding unnecessary disruption of the anterior lamella. By contrast, the transcutaneous approach uses a subciliary skin or skin-muscle incision and provides broader exposure of the lower eyelid and midface tissues. In this approach, preservation of the pretarsal orbicularis remains important to maintain eyelid tone and reduce the risk of postoperative malposition (2,22,26,31).

The central operative step is controlled release of the arcus marginalis and related retaining structures along the infraorbital rim. This release allows the orbital fat to be mobilized beyond the orbital rim rather than being excised. In the medial and central lower eyelid, release of the orbicularis retaining ligament and tear trough ligament reduces tethering at the nasojugal groove and creates space for redraping the fat into the premaxillary or prezygomatic region. The extent of release should remain conservative and anatomy-guided, because excessive detachment may increase postoperative edema, contour irregularity, or lower eyelid instability if adequate support is not maintained (3,22,24,31).

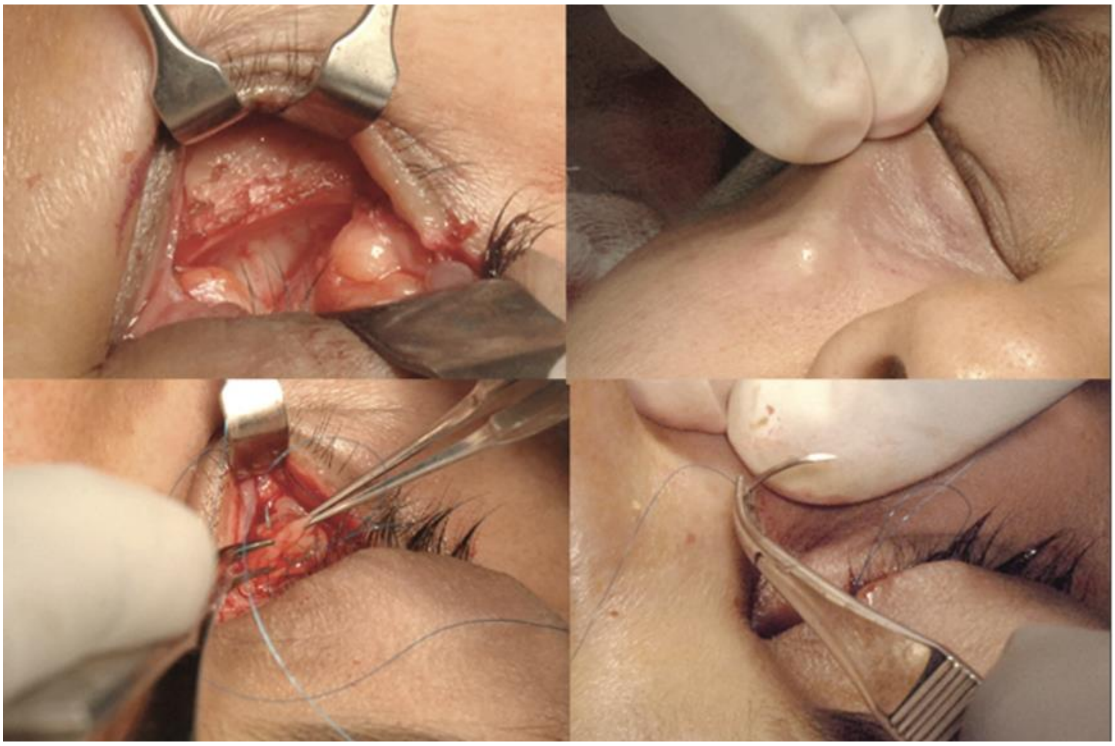

Fig 8. *Transconjunctival lower eyelid fat repositioning after arcus marginalis release: The intraoperative images demonstrate exposure of orbital fat, creation of a subperiosteal pocket, passage of sutures through vascularized fat pedicles, and fixation of the fat along the inferior orbital rim. Reproduced from Naik et al. (1). Available via PubMed Central.*

After release of the retaining structures, the orbital fat is mobilized while preserving its vascularized pedicle. The medial and central fat compartments are usually the most relevant for transposition, as they can be advanced toward the tear trough and infraorbital hollow. Their mobilization should be performed with blunt, conservative dissection to avoid devascularization and volume loss (2,24,28,31). The lateral fat compartment is often treated more cautiously; in some patients, conservative reduction rather than transposition may be preferable, because excessive lateral movement can create contour irregularities (20,27).

Once mobilized, the fat pedicles are advanced across the infraorbital rim into a prepared recipient plane. This plane may be created either subperiosteally or supraperiosteally. A subperiosteal pocket provides a clearly defined space after elevation of the periosteum from the orbital rim and adjacent bone, but concerns have been raised regarding vascular compromise and postoperative edema(2,3,24). The supraperiosteal plane, situated within the SOOF region between the orbicularis oculi muscle and periosteum, may be technically simpler and may better preserve surrounding soft tissues (1,18,24,28).

Stable fixation is required to prevent secondary displacement of the repositioned fat and to maintain a smooth lid-cheek contour during healing. Reported fixation methods include internal absorbable sutures, temporary externalized sutures, periosteal anchoring, guided suture placement, and fibrin glue, with the choice depending on surgeon preference and the specific operative technique

(1,18,20,22,28,30–33). More recently, guided suture techniques and fibrin glue fixation have been described as less invasive alternatives that may reduce tissue trauma and early postoperative recovery time while still providing sufficient stabilization of the repositioned fat (33).

3.4.3.3 Comparison with Fat Grafting and Fillers

Fat repositioning, fat grafting, and soft tissue fillers are the primary modalities used to address the double convexity and hollowing associated with periorbital aging (1,18,22).

Autologous fat grafting is commonly used in patients with global periorbital volume loss or in secondary cases following previous blepharoplasty. Fat is harvested from a donor site, processed, and injected into the periorbital region in multiple layers, including supraperiosteal, submuscular, and subdermal planes. Compared to fat repositioning, this technique allows the application of larger volumes and may improve skin quality (16). The outcomes are less predictable due to variable resorption rates, and complications such as nodules, cyst formation, or contour irregularities may occur (2,16,28,30).

Soft tissue fillers, particularly hyaluronic acid-based products, is a minimally invasive alternative for volume restoration. They are commonly indicated in patients with mild tear trough deformities or in those who prefer non-surgical treatment (19). Advantages include immediate results, minimal downtime, and reversibility in the case of hyaluronic acid fillers (4,19). The results are temporary and improper placement may lead to complications such as the Tyndall effect or overcorrection (10,19,30). In contrast to surgical techniques, fillers do not address the underlying ligamentous or structural causes of the deformity (31).

3.4.3.4 Clinical Outcomes and Synthesis

Published clinical studies generally report favorable aesthetic outcomes and high levels of patient satisfaction following fat repositioning (16,24,28). The outcomes include improvement of tear trough deformity, reduction of lower eyelid bags, smoother lid-cheek transition, and favorable patient satisfaction. Lin et al. reported improvement in lower eyelid bags and tear trough contour with a satisfaction rate of 94.1%, while Miller et al. demonstrated a mean volume gain of 0.64 mL using three-dimensional imaging after fat repositioning lower blepharoplasty (24,31). Zhang et al. also reported improvement in modified Barton scores after transconjunctival fat repositioning with buried-guiding fixation (28).

Fat repositioning with arcus marginalis release represents a volume-preserving alternative to traditional fat excision in lower eyelid blepharoplasty. Its main indication is the coexistence of pseudoherniated orbital fat with tear trough deformity or lid-cheek junction hollowing. By releasing ligamentous attachments at the infraorbital rim and advancing vascularized fat pedicles into the premaxillary and prezygomatic spaces, the technique aims to smooth the transition between the lower eyelid and midface rather than simply reduce lower eyelid fullness.

Reported outcomes suggest improvement in tear trough contour, lower eyelid bags, and patient satisfaction; however, the available evidence remains heterogeneous and is largely based on retrospective studies, small cohorts, subjective outcome measures, and variable follow-up. Therefore, fat repositioning should not be interpreted as universally superior to fat excision or adjunctive volume restoration. Instead, it should be regarded as an anatomy-based option for selected patients in whom volume redistribution is required to restore the lid-cheek transition.

3.5 Reconstructive Lower Eyelid Surgery

3.5.1 Overview and Indications

Lower eyelid reconstruction becomes necessary when tissue loss or structural disruption prevents simple closure and compromises eyelid function, ocular surface protection, or periorbital aesthetics. Common indications include defects after tumor excision, especially after removal of malignant lesions such as basal cell carcinoma, as well as traumatic injuries, burns, cicatricial deformities, infections, congenital abnormalities, and severe postoperative malposition (34–36). In contrast to aesthetic lower eyelid blepharoplasty, the primary aim of reconstruction is not rejuvenation but restoration of eyelid integrity, lid-globe apposition, tear film distribution, and corneal protection.

Several principles guide reconstructive planning. The lower eyelid is a bilamellar structure consisting of an anterior lamella, formed by skin and orbicularis oculi muscle, and a posterior lamella, formed by the tarsal plate and conjunctiva (10,37).

Partial-thickness defects may involve only one lamella, whereas full-thickness defects require restoration of both anterior and posterior lamellae to preserve eyelid stability and function (33,35). Reconstruction should follow the principle of replacing “like with like,” meaning that the substitute tissue should resemble the lost tissue as closely as possible in thickness, texture, vascularity, and functional properties (35,37).

Defect size, depth, and anatomical location are among the most important factors determining the reconstructive approach. Small superficial defects may be managed by direct closure or secondary healing in selected cases, whereas larger defects, full-thickness defects, or defects involving the lid margin usually require flap- or graft-based reconstruction (35,37).

The medial and lateral canthi are particularly important because they contribute to horizontal eyelid tension and stable fixation at the orbital rim. In these regions, reconstruction must preserve eyelid position, tear drainage, and lid-globe apposition.

3.5.2 Local Flap Technique

Local flap techniques are important in lower eyelid reconstruction when primary closure would create excessive tension or distort eyelid position. They use adjacent tissue with preserved vascularity and usually provide a better match in color, texture, and thickness than distant donor tissue (30,33,36). In lower eyelid reconstruction, local flaps are most useful for anterior lamellar replacement. When posterior lamellar support is deficient, they are usually combined with grafts or other posterior lamellar reconstructive techniques.

The Tenzel semicircular flap is mainly indicated for moderate lateral or central lower eyelid defects, usually involving about one third to two thirds of the horizontal lid length (37,38). It advances a semicircular musculocutaneous flap from the lateral periocular region and is often combined with lateral canthotomy or cantholysis to improve mobility and reduce closure tension. Its main advantages are that it can be performed as a single-stage procedure, uses adjacent tissue with similar characteristics, and avoids a distant donor site. The technique depends on sufficient lateral tissue laxity, and excessive tension during closure may contribute to cicatricial ectropion or postoperative lid malposition (33,38).

The Tripier flap uses upper eyelid skin and orbicularis muscle for reconstruction of anterior lamellar defects. Because the upper eyelid provides thin, pliable tissue, this flap can offer a good match for selected lower eyelid defects in terms of color, texture, and thickness (30,33). For larger anterior lamellar or infraorbital defects, the Mustardé cheek rotational-advancement flap may be required. This flap recruits cheek and preauricular tissue to achieve wider coverage, but careful fixation and vector control are essential to avoid downward traction on the lower eyelid. Although myocutaneous flaps provide both skin replacement and soft-tissue support, they are more extensive procedures and may be associated with bulkiness, stiffness, postoperative malposition, or injury to facial nerve branches if dissection is not performed cautiously (32,33)

Fig 9. *Tenzel semicircular rotational flap for reconstruction of a lateral lower eyelid defect. (A) Planned semicircular incision extending superiorly from the lateral defect margin. (B) Mobilization of the myocutaneous flap with selective canthotomy/cantholysis. (C) Medial rotation and fixation of the flap to restore lower eyelid continuity and lateral canthal support. Reproduced from Yan et al. (37) under the Creative Commons Attribution-NonCommercial 4.0 International License.*

3.5.3 Hughes Procedures and their Modifications

The Hughes tarsoconjunctival flap is mainly used for larger full-thickness defects of the lower eyelid, especially when more than 50% of the horizontal lid margin is affected (34,37). As an eyelid-sharing procedure, it reconstructs the posterior lamella by transferring vascularized tarsoconjunctival tissue from the upper eyelid. The anterior lamella must then be reconstructed separately, usually with a full-thickness skin graft or adjacent tissue advancement (34,37,38). A defining limitation of the Hughes procedure is its staged character, because temporary occlusion of the visual axis is required until flap division. The flap remains attached during the initial healing period and is divided at a second stage once sufficient integration has occurred (37–39). Modern modifications aim to reduce donor-site morbidity and improve functional outcome. These include placing the donor incision a few millimeters above the upper lid margin to preserve a marginal tarsal strip, earlier flap division in selected cases, and extended or combined techniques for near-total lower eyelid defects (37,38). Complex Hughes-based reconstructions may be combined with additional anterior lamellar flaps, including bipedicle Tripier-type flaps, when larger or more complex defects require both stable posterior support and adequate anterior coverage. The main advantages of Hughes reconstruction are the use of vascularized native eyelid tissue and reliable posterior lamellar support. Its limitations include temporary visual occlusion, the need for a two-stage procedure, potential donor-site morbidity, and possible long-term ocular surface symptoms such as epiphora or tear film instability (38,39).

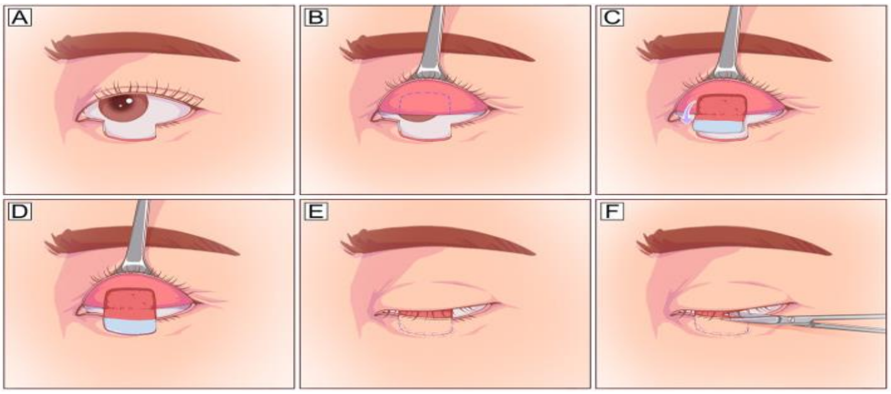

Fig 10. *Two-stage Hughes tarsoconjunctival flap for reconstruction of a central full-thickness lower eyelid defect. (A) Central full-thickness defect involving the lower eyelid margin. (B) Design of the upper eyelid tarsoconjunctival flap while preserving a marginal tarsal strip. (C) Inferior advancement of the flap on a superior conjunctival pedicle. (D) Suturing of the flap to the residual lower eyelid tarsus to reconstruct the posterior lamella. (E) Anterior lamellar reconstruction with a full-thickness skin graft. (F) Flap division after the initial healing period. Reproduced from Yan et al. (37) under the Creative Commons Attribution-NonCommercial 4.0 International License.*

3.5.4 Grafts in Lower Eyelid Reconstruction

Grafts are used in lower eyelid reconstruction when local tissue is insufficient to restore eyelid height, posterior lamellar support, or structural stability (1,10,29). They are particularly relevant in full-thickness defects, posterior lamellar deficiency, cicatricial ectropion, lower eyelid retraction, and vertical eyelid shortening. In these situations, grafts help restore the structural framework of the lower eyelid, improve lid-globe apposition, reduce scleral show, and protect the ocular surface.

A key principle in full-thickness reconstruction is that at least one reconstructed lamella should have an adequate vascular supply. Free grafts are therefore commonly combined with well-vascularized flaps to support graft survival and integration. Autologous tarsoconjunctival tissue is considered particularly suitable for posterior lamellar reconstruction because it resembles the native tarsus and conjunctiva in both structure and function (40). However, the available donor tissue is limited, and sufficient upper eyelid tarsus must be preserved to avoid donor-site morbidity.

Free tarsal grafts may be used when rigid posterior lamellar support and a smooth internal lining are required. They provide good anatomical compatibility but are limited by donor-site availability. Auricular cartilage grafts can provide useful semi-rigid support, especially in larger or more complex defects, but they lack a mucosal surface and may therefore require additional lining tissue to reduce the risk of corneal irritation. Hard palate mucosal grafts are another commonly described option for posterior lamellar reconstruction and spacer grafting, particularly in lower eyelid retraction, because they provide both mucosal lining and structural support (7,40). Donor-site pain, bleeding, and keratinization-related irritation may occur.

Other spacer materials, including chondromucosal grafts and acellular dermal matrix, have also been described (22). These materials may be useful when vertical posterior lamellar lengthening is required or when autologous donor tissue is limited. Nevertheless, graft selection should be individualized according to the defect size, lamellar involvement, need for rigidity, ocular surface requirements, and donor-site considerations. In the context of lower eyelid blepharoplasty, grafts should be understood primarily as reconstructive tools for managing established tissue deficiency or postoperative malposition rather than as routine components of primary aesthetic surgery.

3.5.5 Relevance to Lower Eyelid Blepharoplasty

Although reconstructive lower eyelid surgery differs from primary aesthetic lower eyelid blepharoplasty, it is relevant to this thesis because both fields rely on the same anatomical and functional principles. These include preservation of eyelid stability, adequate posterior lamellar support, canthal integrity, lid-globe apposition, and protection of the ocular surface. Understanding reconstructive principles therefore helps explain why conservative tissue handling and careful preoperative assessment are essential in aesthetic lower eyelid surgery.

Reconstructive techniques become relevant when complications after lower eyelid blepharoplasty leads to structural failure or persistent malposition. Severe lower eyelid retraction, cicatricial ectropion, lagophthalmos, or persistent scleral show may exceed the limits of conservative management or simple canthal tightening. In these cases, posterior lamellar grafting, spacer grafts, local flaps, or more complex reconstructive procedures may be required to restore eyelid height, improve lid-globe apposition, and protect the cornea (34–37).
Including reconstructive techniques in this review also highlights the consequences of excessive skin excision, aggressive fat removal, insufficient canthal support, or missed preoperative risk factors such as horizontal lid laxity and negative vector anatomy. For this reason, reconstructive lower eyelid surgery should not be understood as a routine part of primary cosmetic blepharoplasty, but as an important corrective option when preventive planning has failed or when severe postoperative structural complications occur (10,34–37).

3.6 Complications of Lower Eyelid Blepharoplasty

3.6.1 Ectropion

Postoperative complications remain a critical aspect of lower eyelid blepharoplasty, as even minor technical inaccuracies can result in functional impairment and suboptimal aesthetic outcomes. Among these, lower eyelid malposition, particularly ectropion, represents one of the most clinically relevant and widely discussed complications.

Ectropion manifests when the eyelid margin rotates outward, losing physiological contact with the ocular surface. This functional malposition frequently stems from a failure to correct pre-existing horizontal lid laxity, overly aggressive resection of the anterior lamella, or iatrogenic injury to the motor nerves supplying the orbicularis muscle (22). Alongside this, cicatricial changes involving the middle lamella may pull the lid downward and contribute to postoperative ectropion (4,15,22).
A recurring question in the literature is whether the surgical route itself influences the risk of postoperative ectropion. The transconjunctival approach is often considered advantageous because it avoids a cutaneous incision and minimizes disruption of the anterior lamella. This may explain why several series report very low rates of ectropion or lower eyelid retraction after transconjunctival lower blepharoplasty (1,21,22).
This does not mean that the transcutaneous approach is inherently unsafe. When skin excision is conservative, orbicularis function is preserved, and pre-existing laxity is addressed with adequate canthal support, transcutaneous techniques can also achieve low rates of symptomatic malposition (3,22). Direct comparison between approaches remains limited by heterogeneity in technique, patient selection, and outcome reporting.

Preoperative assessment should focus on factors that reduce lower eyelid support. Horizontal eyelid laxity is particularly relevant and can be assessed clinically with snap-back and distraction testing. Delayed lid return or a distraction distance greater than 6 mm suggests insufficient support and a higher risk of postoperative malposition (4,18,22,26).

Patients with negative vector anatomy are also at increased risk, because anterior projection of the globe relative to the infraorbital rim reduces lower eyelid support. In addition, dissection in the lateral infraorbital danger zone may injure terminal zygomatic nerve branches and weaken orbicularis function, further contributing to postoperative lid malposition (2,8). Prevention of ectropion therefore depends primarily on careful patient selection and appropriate surgical planning. In patients with preexisting laxity, prophylactic canthal support procedures such as canthopexy or canthoplasty are frequently recommended to improve lower eyelid stability (22). Conservative skin resection and preservation of the orbicularis muscle are also important to minimize vertical shortening and functional impairment (17).

Management depends on the severity and timing of the condition. Mild and early cases may be treated conservatively with upward massage, taping, or local steroid injections to reduce scarring. In contrast, persistent or severe ectropion often requires surgical correction, including lateral tarsal strip procedures, skin grafting in cases of anterior lamellar deficiency, or the use of spacer grafts for posterior lamellar support (4,15,22).

3.6.2 Lower Eyelid Retraction and Lagophthalmos

Lower eyelid retraction describes an abnormally low position of the lower eyelid margin, with the lid resting below the inferior limbus in primary gaze (20,22). Clinically, it is often accompanied by scleral show, meaning that the sclera becomes visible between the iris and the lower eyelid margin (17,18,22).

The development of lower eyelid retraction after blepharoplasty is usually multifactorial. Excessive skin excision may create anterior lamellar shortage and vertical shortening of the lower eyelid(1,15,22). Scarring of the middle lamella, especially around the orbital septum, or cicatricial changes of the posterior lamella may exert downward traction on the lid margin (4,15,22). Weakening or denervation of the orbicularis oculi muscle, for example due to injury to branches of the facial nerve during dissection, may further reduce eyelid support (18). Uncorrected horizontal lid laxity may also become clinically relevant after surgery and contribute to postoperative malposition (22).

Patient-related factors should be considered before surgery. Negative vector anatomy, where the globe projects anterior to the infraorbital rim, reduces structural support for the lower eyelid and may increase the risk of postoperative retraction (20,22). Prominent globes, reflected by increased Hertel measurements, may similarly predispose to inferior displacement of the lid Thyroid-associated orbitopathy and previous eyelid surgery can further compromise tissue quality and should therefore be recognized as relevant risk factors during preoperative planning (22).

Treatment depends on the timing, severity, and dominant anatomical mechanism. Mild early retraction may improve with conservative measures such as upward massage, taping, lubrication, or intralesional corticosteroid or 5-fluorouracil injections when cicatricial healing is suspected (22). Persistent or severe cases usually require surgical correction. Depending on the underlying deficiency, this may include lateral canthoplasty or lateral tarsal strip procedures to improve horizontal support, release of cicatricial contracture, posterior lamellar spacer grafts such as hard palate mucosa or acellular dermal matrix, or midface lifting to improve overall lower eyelid support (4,15,20).

Lagophthalmos refers to the inability to achieve complete eyelid closure, resulting in exposure of the ocular surface. It is most commonly observed in the early postoperative period, but may persist if underlying structural or functional deficits are not adequately addressed (4,15,41).

The condition is typically caused by either tissue deficiency or impaired muscular function (15). Excessive skin resection, particularly when involving both upper and lower eyelids, may lead to insufficient tissue for proper closure. In addition, injury to the zygomatic branch of the facial nerve can result in reduced orbicularis oculi function, preventing effective eyelid closure (3,4,20). In some cases, pronounced postoperative chemosis may also contribute to lagophthalmos by mechanically preventing full eyelid closure (41).

The clinical relevance of lagophthalmos lies in the risk of exposure keratopathy. Prolonged corneal exposure may lead to epithelial damage, keratitis, ulceration, and, in severe cases, permanent visual impairment. Patients frequently report symptoms such as dryness, irritation, and reflex tearing (4,15,41). Management is primarily aimed at protecting the ocular surface and supporting eyelid closure. Conservative treatment includes intensive lubrication with preservative-free artificial tears during the day and ointments at night (4,15,20,22). Additional supportive measures, such as eyelid taping during sleep or the use of moisture chambers, may also be beneficial. In more severe or persistent cases, temporary tarsorrhaphy may be required to protect the cornea until the underlying cause has resolved or definitive surgical correction can be performed (1,41).

3.6.3 Chemosis

Chemosis is defined as transudative edema of the conjunctiva and represents a relatively common postoperative finding following lower eyelid blepharoplasty, with reported incidences of up to 11.5% (41). Common contributing factors include surgical exposure, postoperative periorbital edema, and disruption of lymphatic drainage due to tissue dissection (41). Depending on severity and duration, chemosis may be classified into different clinical stages. Mild acute cases are characterized by conjunctival swelling without impairment of eyelid closure. In more severe forms, the degree of edema may mechanically prevent complete eyelid closure, resulting in chemosis-induced lagophthalmos. If swelling persists for several weeks, it may be considered subchronic. In some cases, chemosis may also occur secondary to underlying eyelid malposition, such as ectropion (41).

Management is generally guided by severity. Mild cases are usually treated conservatively with intensive lubrication using artificial tears and ointments, often in combination with topical corticosteroids and ocular decongestants. Additional mechanical measures, such as pressure patching or elastic compression, may also support resolution. In more persistent or severe cases, surgical intervention may be required. Reported options include conjunctivotomy to facilitate fluid drainage or temporary tarsorrhaphy to protect the ocular surface and reduce exposure (41).

Preventive measures may help reduce the risk of postoperative chemosis. These include postoperative head elevation, application of cold compresses, and, in selected high-risk patients, the intraoperative use of temporary tarsorrhaphy sutures to reduce conjunctival exposure and edema formation (27,41).

3.6.4 Diplopia

Diplopia is an uncommon but clinically important complication of lower eyelid blepharoplasty. In most cases, it is transient, but persistent cases have also been reported (15,22).

Temporary diplopia may occur because of postoperative edema or diffusion of local anesthetic into adjacent orbital tissues Injection into orbital fat can allow anesthetic spread toward neural or extraocular muscle structures, causing short-lived ocular motility disturbance that usually resolves within a limited postoperative period (15). Persistent diplopia is more concerning and is most often discussed in relation to inferior oblique muscle injury. This muscle lies between the medial and central lower eyelid fat compartments and is therefore vulnerable during fat dissection or fat repositioning (4,15,22). Excessive dissection, cauterization, or improper handling of fat pedicles during repositioning may lead to direct trauma or tethering of this muscle (8,15).

Management depends on the underlying cause and duration of symptoms. Transient cases are generally self-limiting and may be managed with observation alone (21,22). In persistent cases, conservative measures such as ocular exercises may be considered (15). If structural injury is suspected or symptoms fail to resolve, referral for surgical correction may be necessary (15,22). Careful intraoperative identification and preservation of the inferior oblique muscle therefore remain important in minimizing the risk of this complication.

3.6.5 Retrobulbar Hemorrhage

Retrobulbar hemorrhage is a rare but vision-threatening complication of lower eyelid blepharoplasty. It may occur when intraorbital bleeding causes a rapid rise in orbital pressure, with potential compression of the optic nerve and central retinal artery if treatment is delayed (2,4,22). Clinical warning signs include escalating periorbital pain, proptosis, a tense orbit, chemosis, reduced visual acuity, and, in severe cases, an afferent pupillary defect (2,4,22). Because irreversible visual damage can occur quickly, suspected retrobulbar hemorrhage should be treated as an ophthalmic emergency. Initial management includes urgent orbital decompression, most commonly by lateral canthotomy with inferior cantholysis, followed by immediate ophthalmological assessment (2,4,22). Prevention relies on careful perioperative risk management, including review of anticoagulant or antiplatelet therapy, meticulous intraoperative hemostasis, blood pressure control, and avoidance of Valsalva-provoking factors in the early postoperative period (3,4).

4 Research Results and Discussion

The main clinical studies relevant to surgical techniques, complications, and outcomes in lower eyelid blepharoplasty are summarized in Appendix 1. Review articles, anatomical studies, epidemiological reports, methodological references, and sources used only for background information were not included in this table.

4.1 Overview of Included Literature

Across the reviewed literature, lower eyelid blepharoplasty is increasingly discussed within a volume-preserving or volume-restoring framework rather than a purely subtractive one (27). This reflects the growing emphasis on age-related volume redistribution, contour imbalance, and changes at the lid-cheek junction, rather than skin excess alone (2,17,27).

The studies summarized in Appendix 1 varied in design, patient selection, surgical technique, follow-up duration, and outcome assessment. Sample sizes ranged from 10 to 697 patients, with follow-up durations ranging from approximately three months to several years (24,26,27). Therefore, the results of this review are synthesized descriptively rather than quantitatively.

4.2 Transconjunctival versus Transcutaneous Approach

The reviewed literature suggests that both transconjunctival and transcutaneous approaches remain established techniques, but their indications differ. A concise comparison of the main indications, advantages, limitations, and complication profiles of the transconjunctival and transcutaneous approaches is provided in Appendix 2.

Selection of the surgical route should be guided by anatomy rather than by surgeon preference alone. Relevant factors include the degree of skin excess, horizontal eyelid laxity, orbital vector, fat distribution, and whether anterior lamellar correction is required. Patients with negative vector anatomy, in whom the globe projects relatively anterior to the infraorbital rim, have less skeletal support for the lower eyelid and may therefore be more prone to postoperative malposition, including ectropion or lid retraction. In this subgroup, a transconjunctival approach is often preferable when skin redundancy is limited, because it avoids disruption of the anterior lamella. If a transcutaneous approach is selected despite negative vector anatomy, it should generally be reserved for patients with relevant dermatochalasis and combined with preventive canthal support, such as canthopexy, to reduce the risk of postoperative instability (2,4,10,18,26). The satisfaction rates stated by Lin et al. (94.1%) and Hu et al. (94.2%) should be viewed critically, as these numbers cannot be directly compared due to different measurement components and patient groups. While the transconjunctival approach might be safer regarding lid position, it often requires additional interventions, such as a skin pinch or laser resurfacing, if skin excess remains. The reviewed literature does not support one universally superior approach. Instead, surgical access should be selected according to the dominant anatomical problem, including skin excess, eyelid laxity, orbital vector, fat distribution, and the need for anterior lamellar correction.

4.3 Fat Excision versus Fat Repositioning

A central finding of this review is the increasing shift from traditional fat excision toward fat preservation and fat repositioning in contemporary lower eyelid blepharoplasty. Earlier techniques primarily focused on removing protruding orbital fat to reduce lower eyelid fullness. Conservative fat excision may still be appropriate in selected patients with isolated orbital fat pseudoherniation and preserved infraorbital volume. Although fat repositioning is increasingly used as part of contemporary volume-preserving lower eyelid blepharoplasty, its additional technical complexity is not justified in every patient and should be weighed against the anatomical indication, expected contour improvement, and potential postoperative morbidity. According to Hamra, fat repositioning is clinically appropriate since volume is being restored rather than excised; this is supported by analyses of data by Miller et al. with a volume gain of only 0.64 ml. The clinical relevance of a measured mean volume gain of 0.64 mL must be interpreted cautiously, because the benefit of contour restoration must be weighed against the added technical complexity, longer edema, and potential risks of deeper dissection. While the repositioning method is rational in a tear trough deformity, the conservative technique of fat excision for patients with isolated pseudoherniation of fat pads and appropriate midface volume is more efficient and bears lesser risk (2,22,29).

However, excessive fat removal can contribute to postoperative hollowing, skeletonization of the infraorbital rim, and an aged or overcorrected appearance. Therefore, the decision between fat excision and fat repositioning should not be based only on the presence of orbital fat prominence, but also on the degree of tear trough deformity and lid-cheek junction hollowing. Many studies are retrospective and rely on subjective aesthetic evaluation rather than standardized outcome measures. In addition, fat repositioning is technically more demanding than simple fat excision because it may require arcus marginalis release, preparation of a subperiosteal or preperiosteal recipient pocket, mobilization of vascularized fat pedicles, and stable fixation. These additional steps may increase the risk of prolonged edema, contour irregularities, or complications related to deeper dissection. (21,29).

4.4 Reconstruction and structural integrity

The integration of reconstructive principles into this review reflects the clinical reality that severe complications of lower eyelid blepharoplasty, including cicatricial ectropion, posterior lamellar deficiency, and persistent retraction, may require techniques beyond simple canthal tightening. As discussed in section 3.5, procedures such as hard palate mucosal grafts, tarsoconjunctival flaps, and local rotation flaps are relevant corrective operations when primary aesthetic surgery results in structural tissue deficiency (34–37). Understanding the lamellar architecture of the lower eyelid and the reconstructive hierarchy therefore supports more conservative decision making during primary aesthetic surgery, particularly regarding the extent of skin excision and fat removal.

4.5 Complication Patterns and Preventive Strategies

The most clinically relevant complications discussed in the reviewed literature include lower eyelid malposition (such as ectropion and retraction), chemosis, lagophthalmos, diplopia, dry eye symptoms, and rare but potentially sight-threatening hemorrhagic complications. These complications are closely related to patient-specific risk factors and technical aspects of surgery (3,10).

Reported complication rates vary significantly between studies, which may reflect differences in surgical technique as well as follow-up duration. For instance, Hu et al. described lateral rounding in 6.6% and scleral show in 3.2% of patients (26,41). Alhumaemydi et al. reported scleral show in only 1.0% (20). Weinfeld et al. reported a higher incidence of chemosis at 11.5%. These discrepancies suggest that complications might be underreported in studies with shorter observation periods, as cicatricial changes and malpositions often develop progressively during the healing process (20). This also underlines why familiarity with reconstructive options is practically relevant for any surgeon performing aesthetic lower eyelid surgery, since severe complications such as cicatricial ectropion or persistent retraction may require techniques well beyond simple canthal tightening (34–37).

Lower eyelid malposition remains the primary concern. Key risk factors include pre-existing horizontal eyelid laxity, negative vector anatomy, and excessive skin excision. Preventive strategies must include a meticulous preoperative assessment and the use of canthal support procedures, such as canthopexy, in patients with increased anatomical risk. While functional issues like chemosis or lagophthalmos are often transient, they require active management to protect the ocular surface. Ultimately, complication prevention depends less on the chosen surgical approach alone and more on an individualized, anatomy-based planning that integrates reconstructive principles to ensure long-term structural integrity.

4.6 Patient Satisfaction and Aesthetic Outcomes

Patient satisfaction and aesthetic outcome interpretation remain limited by heterogeneous outcome measures and often subjective assessment methods. While studies by Alhumaemydi et al. and Lin et al. report satisfaction rates exceeding 94%, these figures must be interpreted with academic caution. Most included studies rely on non-validated, subjective scoring systems or simple binary 'recommendation' questions. This creates a significant observer bias, as the operating surgeon often performs the outcome assessment themselves. Furthermore, the lack of standardized, patient-reported outcome measures (PROMs), such as the FACE-Q, limits the scientific comparability of these results. High satisfaction rate in elective aesthetic surgery may partly reflect expectation bias and the subjective nature of outcome assessment rather than technique-specific advantages (16,24,28).

4.7 Limitations of the Available Evidence

The available evidence on lower eyelid blepharoplasty remains limited by several methodological factors. Many clinical studies are retrospective, single-center case series with relatively small sample sizes, and patient selection, operative technique, adjunctive procedures, and follow-up duration vary considerably between studies (20,24,26,27). These differences make direct comparison between surgical approaches difficult.

Another important limitation is the lack of standardized outcome assessment. Many publications report patient satisfaction or aesthetic improvement without using validated scoring systems (19). In addition, complications may be underreported, especially if follow-up is short or if minor functional complaints are not systematically assessed.

Finally, anatomical and aging studies are often based on specific ethnic cohorts, which may limit generalizability to other populations. Because facial skeletal structure, soft tissue thickness, pigmentation tendency, and aesthetic preferences may vary between patient groups, conclusions from one population should not be applied uncritically to all patients (19).

For these reasons, the conclusions of this review should be interpreted cautiously. The current literature supports individualized, anatomy-based surgical planning, but does not provide sufficient high-level evidence, such as randomized controlled trials, to recommend one universally superior technique.

5 Conclusion

This literature review suggests that contemporary lower eyelid blepharoplasty has shifted from predominantly subtractive techniques toward more individualized and volume-preserving approaches. Surgical planning should be guided by patient-specific anatomy, including orbital fat prominence, lower eyelid skin excess, eyelid laxity, orbital vector, and the contour of the lid-cheek junction. The transconjunctival approach remains particularly suitable for patients with isolated orbital fat pseudoherniation and relatively preserved lower eyelid skin. In contrast, the transcutaneous approach remains important when significant dermatochalasis, orbicularis laxity, or anterior lamellar correction must be addressed. Current evidence does not support one universally superior technique; rather, both approaches have specific indications, advantages, and limitations.

Fat repositioning and arcus marginalis release reflect the increasing emphasis on volume preservation and contour restoration in lower eyelid rejuvenation. These techniques may be especially useful when orbital fat prominence coexists with tear trough deformity or lid-cheek hollowing. However, fat repositioning should not be interpreted as universally superior to conservative fat excision, as the available literature remains limited by heterogeneous study designs, variable surgical techniques, inconsistent outcome measures, and predominantly retrospective data.

Reconstructive principles are relevant to lower eyelid blepharoplasty because they provide an anatomical and functional framework for understanding severe complications such as ectropion, lower eyelid retraction, and tissue deficiency. Techniques such as local flaps and graft-based reconstruction are not the primary focus of aesthetic blepharoplasty, but they are important for the management of selected severe structural complications.

Overall, successful outcomes depend on careful preoperative assessment, appropriate patient selection, conservative tissue handling, and individualized surgical planning. Future research should include longer follow-up, standardized complication reporting, and validated patient-reported outcome measures, such as FACE-Q, to improve the comparability and clinical relevance of the available evidence.

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Appendix 1:

This table summarizes the main clinical studies included in the qualitative synthesis.

Author/year	Study design	Sample	Technique/ Topic	Follow-up	Main findings	Reported complications	Main limitations
Alhumaemydi et al. 2025	Retrospective chart review	265	Transcutaneous blepharoplasty + canthal support	Median 120 days (3–18 months)	98.5% would recommend; low revision rate	Edema 2.3%; scarring 1.9%; scleral show 1.0%; hematoma 0.8%	Retrospective; variable follow-up
Kikuchi et al. 2025	Retrospective comparative study	127 (55 suture group, 72 fibrin glue group)	Transconjunctival fat transposition; fibrin glue vs sutures	3 months	Less early discoloration/hematoma with fibrin glue; similar long-term outcome	Ectropion/adhesions in both groups; less bruising with fibrin glue	Retrospective; short follow-up
Lin et al. 2025	Retrospective analysis	17	Transconjunctival orbital fat release/repositioning	Mean 5.7 months (3–12 months)	Improved eyelid bags/tear trough; 94.1% satisfaction	Ecchymosis/swelling common; congestion 35.3%; bleeding 11.8%	Small sample; non-comparative
Zhang et al. 2025	Prospective, single-center cohort study	30	Transconjunctival fat repositioning; buried-guiding fixation	Mean 6.2 months (3–12 months)	Barton score improved 3.2→0.83; 60% excellent	No major complications reported	No control group; short follow-up
Miotto et al. 2023	Retrospective case series	80	Skin-only flap + conservative fat management + microfat grafting	6 to 10 months	Improved periorbital deflation; volume preservation	Under-resection/absorption 10%; minor cysts/infection/scleral show	Single-surgeon series; limited quantitative data
Hu et al. 2021	Retrospective chart review	697	Transcutaneous three-step support technique	6 to 36 months	94.2% improvement; 95.1% normal lid position	Lateral rounding 6.6%; scleral show 3.2%; eversion 1.7%	Subjective scale; population-specific findings
Huang et al. 2019	Retrospective analysis	205	Transcutaneous blepharoplasty + MAFT	Mean 60.2 months (range 18–90 months)	Satisfaction 4.70/5; durable contour improvement	Transient retraction 2.0%; no major complications	Retrospective; subjective outcomes
Miller et al. 2016	Retrospective electronic medical record review	10	Transconjunctival fat repositioning + ORL/TTL release	Mean 12 months (10–16 months)	Mean volume gain 0.64 mL by 3D imaging	None reported	Small sample; landmark variability
Weinfeld et al. 2008	Retrospective chart review	312	Transcutaneous skin-muscle flap + canthal support	Not specified; chemosis duration followed until resolution (median 4 weeks)	Chemosis classification and treatment algorithm	Chemosis 11.5%	Single-technique study

Appendix 2.

Comparison of Transconjunctival and Transcutaneous Lower Lid Blepharoplasty

Feature	Transconjunctival approach	Transcutaneous / skin-muscle flap approach
Incision	Internal conjunctival incision; no external skin incision.	External subciliary incision with skin or skin-muscle flap elevation.
Main indication	Pseudoherniation/orbital fat prominence with limited skin excess and relatively preserved anterior lamella.	Skin redundancy, orbicularis laxity, anterior lamellar excess, or need for direct skin-muscle correction.
Skin management	Does not directly correct notable skin excess; may be combined with skin pinch, laser resurfacing, or chemical peel if needed.	Allows direct correction of skin and orbicularis muscle excess; requires conservative resection to avoid malposition.
>Fat management	Fat excision, fat repositioning, or fat transposition can be performed through the conjunctival route.	Fat excision, fat repositioning, or fat transposition can be combined with skin-muscle flap management.
External scar	No visible external scar.	Potential visible subciliary scar; risk depends on incision placement, healing, and patient factors.
Main advantages	Preserves anterior lamella, avoids external scar, and is useful when skin quality is good.	Provides broad exposure and allows combined management of skin, muscle, fat compartments, and canthal support.
Main limitations	Limited effect on marked dermatochalasis or orbicularis laxity if used alone.	Greater risk of lower eyelid malposition if excessive skin/muscle is removed or canthal support is inadequate.
Important complications	Chemosis, conjunctival irritation, residual skin redundancy, undercorrection, or transient ocular surface symptoms.	Ectropion, lower eyelid retraction, scleral show, scarring, chemosis, dry eye symptoms, or overcorrection.
Common adjuncts	Skin pinch, resurfacing, fat repositioning, fat grafting/fillers, and canthal support in selected patients.	Canthopexy/canthoplasty, SOOF lift, resurfacing, conservative skin excision, and fat repositioning/transposition.
Clinical interpretation	Best suited when the dominant problem is fat prominence with preserved skin envelope.	Best suited when anterior lamellar excess or orbicularis laxity requires direct correction.