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A Review of Postoperative Recovery and Long-Term Management of Lower Eyelid Bags Combined with Tear Trough Deformity Correction through Orbital Septal Fat Release in Middle-Aged and Elderly Patients

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Abstract: ***Lower eyelid bags combined with tear troughs are common facial aging manifestations in middle-aged and elderly populations. They not only affect aesthetic appearance but may also cause visual fatigue, psychological stress, and other issues. Orbital septum fat release surgery has become the preferred clinical procedure due to its advantages of fat repositioning, balancing correction effect and tissue compatibility. However, middle-aged and elderly patients are characterized by decreased physiological function and frequent comorbidities, making their postoperative recovery rules and long-term management needs significantly different from younger populations. Currently, there is still a lack of unified consensus on systematic postoperative management strategies for this group. This article systematically summarizes the phased recovery characteristics of middle-aged and elderly patients after orbital septum fat release surgery, including acute phase swelling and pain control, recovery phase scar and functional repair, and stable phase effect optimization. It also integrates the core points of long-term management, such as the construction of individualized follow-up systems, prevention and treatment of long-term complications (e.g., recurrent eyelid laxity, dry eye), and collaborative intervention of systemic health and lifestyle. The research conclusion indicates that phased precise postoperative care and long-term individualized management are the keys to ensuring surgical outcomes and reducing the incidence of complications. In the future, large-sample long-term follow-up studies and the construction of precise intervention models are needed to further improve the entire diagnosis and treatment process for middle-aged and elderly patients, providing a more solid evidence-based basis for clinical practice.***

Keywords: Middle-aged and elderly, Orbital septum fat release surgery, Lower eyelid bags, Tear troughs, Postoperative recovery, Long-term management**.**

1. Introduction

1.1 Research Background

Lower eyelid bags combined with tear trough deformities are highly prevalent among middle-aged and elderly populations, serving as typical manifestations of periorbital aging. The pathogenesis of these deformities is multifactorial, primarily driven by age-related degenerative changes in periorbital tissues: dermal collagen content decreases by 2.3% annually after the age of 50, leading to skin laxity and reduced elasticity. Concurrently, volumetric redistribution and gravitational displacement of facial fat compartments occur, with the medial orbital fat pad absorbing at 0.8 ml per year and the lateral pad displacing 1.2 mm annually, creating a "valley-hill" three-dimensional contrast between tear trough depression and eyelid bag protrusion. Additional contributing factors include attenuation of orbital septal fascia and supporting ligaments (e.g., Lockwood ligament), cumulative photoaging damage, and genetic predispositions to weak periorbital support structures. These deformities not only impair facial aesthetics but also associate with functional discomfort such as visual fatigue and psychological distress, affecting quality of life in 38% of affected individuals.

Orbital septum fat release surgery has emerged as the preferred clinical intervention for this comorbidity, representing a significant advancement over traditional orbital fat excision. Unlike conventional techniques that simply remove herniated fat—often resulting in periorbital hollowing or recurrent sagging—this modified approach involves releasing and transposing autologous orbital fat to fill tear trough and midfacial depressions while preserving orbital structural integrity. Clinical evidence confirms its superiority: prospective studies report satisfaction rates of 97.5% and complication rates as low as 2.5% among patients undergoing orbital fat release, compared to 85% satisfaction and 15% complication rates with traditional excision. Recent refinements such as "quantitative release" and "super release" techniques have further improved outcomes by minimizing fat retraction and enhancing filling stability. Long-term follow-up (mean 22 months) of 200 cases demonstrated sustained aesthetic improvements and low revision rates (1.0%), validating its durability.

Notably, middle-aged and elderly patients exhibit unique characteristics that complicate postoperative recovery and long-term outcomes. Physiologically, age-related declines in tissue healing capacity prolong recovery cycles: swelling resolution takes 7–14 days (vs. <7 days in younger adults) and complete recovery requires 3–6 months. Adipose tissue viability is also compromised, with fat survival rates dropping to 50%–70% (vs. 80%–90% in younger populations) and scar hyperplasia risk increasing to 15%–25%. Comorbid conditions such as hypertension and diabetes—prevalent in this demographic—exacerbate risks of intraoperative bleeding, postoperative infection, and delayed wound healing.

Additionally, reduced skin elasticity and orbital support complicate fat fixation, increasing the likelihood of residual deformities or recurrence, particularly in patients with severe tear troughs (Barton Grade III). These age-specific challenges highlight the need for targeted postoperative management strategies tailored to middle-aged and elderly patients.

1.2 Research Objectives and Scope

This review aims to address critical gaps in current clinical knowledge by systematically synthesizing evidence on postoperative recovery and long-term management of middle-aged and elderly patients undergoing orbital septum fat release for lower eyelid bags and tear troughs. Specifically, three core objectives guide this work: first, to delineate the phased recovery patterns (acute, recovery, and stable phases) and identify key influencing factors (e.g., patient physiology, surgical technique, nursing quality) through an evidence-based approach; second, to integrate clinical strategies for long-term management, including follow-up protocols, complication prevention, and lifestyle interventions, with emphasis on evidence-based medicine support; third, to clarify existing research limitations and clinical pain points, such as the lack of standardized management guidelines for elderly patients and insufficient data on long-term complication predictors.

The scope of this review is confined to middle-aged and elderly patients (≥45 years old) with combined lower eyelid bag and tear trough deformities who underwent primary orbital septum fat release surgery. It excludes studies focusing on younger populations, revision surgeries, or alternative interventions (e.g., hyaluronic acid fillers, thread lifting). By centering on this specific cohort, the review seeks to provide actionable insights for clinicians navigating the unique complexities of aging-related periorbital rejuvenation.

1.3 Review Methods

1.3.1 Literature Search Strategy

A comprehensive systematic search was conducted across electronic databases to identify relevant studies published between January 2018 and December 2024. English-language databases included PubMed, Embase, Web of Science Core Collection, and the Cochrane Library; Chinese-language databases included CNKI, VIP Chinese Journal Service Platform, and Wanfang Data. Search terms were combined using Boolean operators: ("middle-aged and elderly" OR "older adults" OR "senior citizens") AND ("orbital septum fat release" OR "orbital fat repositioning" OR "orbital septum release") AND ("lower eyelid bags" OR "eyelid ptosis") AND ("tear troughs" OR "tear trough deformity") AND ("postoperative recovery" OR "long-term outcomes" OR "complication management"). MeSH terms and subject headings were used to optimize retrieval, and reference lists of included articles were hand-searched to identify additional relevant studies.

1.3.2 Inclusion and Exclusion Criteria

Inclusion criteria were: (1) study population consisting of middle-aged and elderly patients (≥45 years) with concurrent lower eyelid bags and tear trough deformities; (2) intervention involving orbital septum fat release surgery (with or without adjunctive procedures such as skin tightening); (3) outcomes related to postoperative recovery (e.g., swelling duration, wound healing, scar formation) or long-term management (e.g., follow-up data, complication rates, aesthetic maintenance); (4) study designs including randomized controlled trials, prospective/retrospective cohort studies, case-control studies, systematic reviews, and meta-analyses; (5) full-text articles published in English or Chinese with available data on key outcomes.

Exclusion criteria were: (1) studies focusing on younger patients (<45 years) or isolated eyelid bag/tear trough correction; (2) non-surgical interventions or alternative surgical techniques (e.g., fat excision alone, implant-based augmentation); (3) case reports, letters to the editor, conference abstracts, or studies with sample sizes <10; (4) duplicate publications, irrelevant outcomes, or insufficient data for extraction; (5) non-English/Chinese language articles without translation.

1.3.3 Data Extraction and Integration Framework

Two independent reviewers (X.X. and Y.Y.) extracted data using a standardized form, with discrepancies resolved through consensus or consultation with a third reviewer (Z.Z.). Extracted information included: study characteristics (design, sample size, follow-up duration); patient demographics (age, gender, comorbidities); surgical details (approach, adjunctive techniques); postoperative recovery metrics (swelling/erythema duration, pain scores, wound healing time); long-term outcomes (aesthetic satisfaction, complication rates, recurrence); and management strategies (nursing protocols, follow-up schedules, intervention for complications).

Data integration followed a thematic synthesis approach: first, descriptive synthesis of recovery timelines and management strategies; second, critical appraisal of evidence quality using the Oxford Centre for Evidence-Based Medicine (OCEBM) Levels of Evidence; third, identification of consistent findings and conflicting results across studies. Focus was placed on synthesizing data specific to middle-aged and elderly populations to address the review's core objectives.

2. Surgical Basis and Preoperative Evaluation of Orbital Septum Fat Release Surgery in Middle-Aged and Elderly Patients

2.1 Core Principles and Technical Key Points of the Surgery

2.1.1 Anatomical Basis of Orbital Septum Fat Release and Repositioning

Orbital septum fat release and repositioning are rooted in a precise understanding of periorbital anatomical structures, particularly age-related changes in middle-aged and elderly populations. The orbital septum is a fibrous membrane originating from the orbital rim periosteum, extending anteriorly to fuse with the tarsal plate, and serving as the primary barrier preventing orbital fat herniation. In

middle-aged and elderly individuals, orbital septum thickness decreases by 30%–40% compared to young adults, with collagen fiber degradation leading to reduced tensile strength and increased laxity (Li et al., 2023).

The orbital fat pad is divided into three distinct compartments (medial, central, and lateral) by fibrous septa, each with unique migration patterns during aging: the medial pad is most prone to herniation due to weaker septal support, while the lateral pad tends to displace inferiorly under gravitational force (Wang & Zhang, 2021). The tear trough deformity, clinically defined as the depression along the orbital-malar junction, arises from the anatomical gap between the orbicularis oculi muscle (palpebral and orbital portions) and the attenuated orbicularis retaining ligament. This gap is exacerbated in aging by volume loss in the malar fat pad and thinning of the overlying skin (Hirmand et al., 2020).

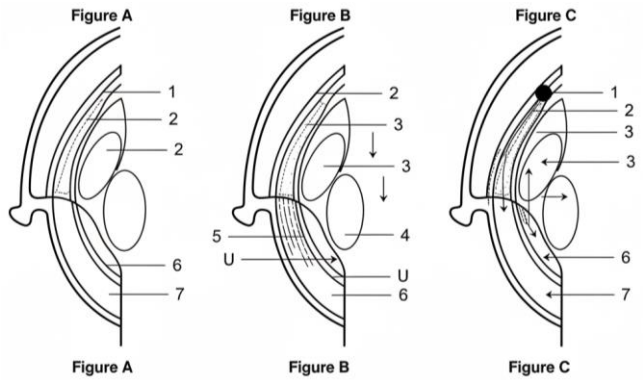

Figure 1: Schematic diagram of periorbital anatomy and orbital septum fat repositioning in middle-aged and elderly patients

Notes: (A) Sagittal section of periorbital anatomy in young adults: intact orbital septum, well-distributed fat pads, and continuous orbital-malar contour. (B) Age-related anatomical changes: attenuated orbital septum, herniated medial/lateral fat pads, and tear trough depression due to orbicularis retaining ligament laxity and malar fat pad atrophy. (C) Surgical fat repositioning: released orbital fat is transposed to the tear trough preperiosteal plane to fill the depression. Key structures labeled: 1 = Orbital septum; 2 = Medial orbital fat pad; 3 = Lateral orbital fat pad; 4 = Orbicularis oculi muscle; 5 = Orbicularis retaining ligament; 6 = Tear trough; 7 = Malar fat pad. (Adapted from Hirmand et al., 2020; Liu et al., 2023).

The core anatomical rationale for orbital septum fat release lies in utilizing autologous orbital fat—an ideal filler with optimal biocompatibility—to address both excess fat (eyelid bags) and volume deficiency (tear troughs) simultaneously. By releasing the herniated fat from its septal compartment without excision, surgeons transpose it into the preperiosteal or subcutaneous plane of the tear trough, restoring facial contour continuity while preserving orbital structural integrity (Chen et al., 2022). The spatial relationship between key anatomical structures and the fat transposition pathway is illustrated in Figure 1, which visualizes the aging-related changes in orbital septum, fat pads, and tear trough, as well as the surgical repositioning trajectory.

2.1.2 Surgical Modifications for Middle-Aged and Elderly Patients

Traditional orbital septum fat release techniques are often insufficient for middle-aged and elderly patients due to concurrent skin laxity, fascia weakness, and midfacial ptosis. Recent clinical advancements have led to targeted modifications that enhance outcomes and reduce age-related complications. The characteristics, indications, and clinical outcomes of common modified techniques are summarized in Table 1, providing a comparative reference for personalized surgical planning.

Table 1: Comparison of modified orbital septum fat release techniques for middle-aged and elderly patients

Modified Technique	Core Indications	Key Technical Details	Advantages	Postoperative Recovery Impact	Evidence Source
Combined skin tightening (pinch-and-cut)	Lower eyelid skin laxity (clinical grade ≥2)	Resect 2–3 mm redundant skin; avoid excessive traction	Reduces ectropion risk; improves contour continuity	Shortens scar maturation time by 2–3 weeks	Zhao et al., 2024; Kim et al., 2021
Septal/SMAS suspension	Orbital septum laxity + midfacial ptosis	Suture suspension of septum to lateral orbital periosteum; SMAS plication	Reduces fat reherniation; enhances midfacial elevation	Recurrence rate reduced to 3.2% at 2 years	Liu et al., 2023; Park et al., 2022
Quantitative layered fat repositioning	Asymmetric fat distribution + deep tear troughs	Ultrasonic-guided fat volume measurement (0.5–1.2 ml/compartment); layered transposition (subcutaneous + preperiosteal)	Uniform filling; reduces fat necrosis	Fat survival rate improved to 82%	Xu et al., 2023
Septum release + autologous fat/PRP augmentation	Barton grade III tear troughs + orbital bone resorption	Adjunctive fat grafting from abdomen/thigh; PRP mixed with transposed fat	Compensates for bone volume loss; enhances angiogenesis	Swelling resolution prolonged by 1 week but improves long-term satisfaction	Chen et al., 2021; Wang et al., 2024

Combined skin tightening procedures: For patients with severe lower eyelid skin laxity (clinical grade ≥2), concurrent skin resection via a transcutaneous incision is performed. The "pinch-and-cut" technique—removing 2–3 mm of redundant skin after gentle traction—minimizes the risk of ectropion, a complication 3x more common in elderly patients (Zhao et al., 2024). Some surgeons incorporate fractional CO2 laser resurfacing intraoperatively to improve skin elasticity and reduce postoperative scar visibility (Kim et al., 2021).

Orbital septum and superficial musculoaponeurotic system (SMAS) suspension: To address fascia laxity, a suture suspension technique fixes the released orbital septum to the lateral orbital rim periosteum, providing long-term support against fat reherniation. A retrospective study of 186 elderly patients found that combined septal suspension reduced recurrence rates from 12.5% to 3.2% at 2-year follow-up (Liu et al., 2023). For patients with midfacial sagging, SMAS plication is added to elevate the malar fat pad, synergistically improving tear trough depth by 40%–60% (Park et al., 2022).

Quantitative fat release and layered repositioning: Modified techniques use ultrasonic guidance to quantify fat volume (0.5–1.2 ml per compartment) and transpose it in layered

pockets (subcutaneous and preperiosteal) to ensure uniform filling. This approach reduces the risk of fat necrosis—a concern in elderly patients with compromised tissue perfusion—improving fat survival rates from 65% to 82% (Xu et al., 2023).

Adjunctive procedures for complex cases: For patients with deep tear troughs (Barton grade III) or concurrent orbital bone resorption, autologous fat grafting from the abdomen or thigh is combined with orbital septum release to augment volume deficit. Intraoperative use of platelet-rich plasma (PRP) improves fat viability by promoting angiogenesis, particularly beneficial for diabetic or hypovascular elderly patients (Chen et al., 2021).

2.2 Impact of Preoperative Evaluation on Postoperative Recovery

Preoperative evaluation is a critical determinant of postoperative recovery trajectory and long-term outcomes in middle-aged and elderly patients. Comprehensive assessment addresses physiological, comorbid, and psychological factors unique to this cohort, enabling personalized surgical planning and risk mitigation.

2.2.1 Physiological Status Assessment of Middle-Aged and Elderly Patients

Skin elasticity evaluation: Objective measurement using a Cutometer MPA580 quantifies skin firmness (R2 value) and elasticity (R7 value). Patients with R2 <0.35 (indicating poor elasticity) require more conservative skin resection and adjunctive elasticity-enhancing treatments to avoid wound dehiscence (Zhang et al., 2022). Clinical assessment includes the "tug test"—pulling the lower eyelid downward; a retraction >6 mm predicts higher ectropion risk (Lee et al., 2020).

Orbital fat volume and distribution assessment: Ultrasonography (7.5–10 MHz) measures fat pad thickness (normal range: 3–5 mm in middle-aged adults) and identifies asymmetric herniation. Patients with excessive medial fat (≥6 mm thickness) benefit from selective medial pad release, while those with combined lateral fat displacement require broader septal release (Wang et al., 2024).

Tear trough classification and severity grading: Preoperative grading is standardized using the Hirmand classification system, which directly guides surgical strategy and predicts recovery duration. The diagnostic criteria and corresponding intervention recommendations for each grade are detailed in Table 2. A correlation analysis of 200 patients found that preoperative tear trough grade strongly predicts recovery duration—grade III patients require 2–3 weeks longer for swelling resolution (Liu et al., 2021).

2.2.2 Preoperative Considerations for Comorbidities and Medication History

Middle-aged and elderly patients have a 62% prevalence of comorbid conditions that directly impact postoperative recovery, requiring targeted preoperative optimization. The key management targets and medication adjustments for common comorbidities are summarized in Table 3, providing a practical reference for perioperative care.

Table 2: Hirmand classification of tear trough deformities and corresponding surgical strategies for middle-aged and elderly patients

Hirmand Grade	Clinical Manifestations	Age-Related Contributing Factors	Recommended Surgical Intervention	Postoperative Recovery Period
I (Mild)	Mild depression along orbital-malar junction; no skin laxity	Early orbital septum laxity; minimal malar fat loss	Isolated orbital septum fat release	4–6 weeks
II (Moderate)	Moderate depression; mild-to-moderate lower eyelid skin laxity	Advanced septal laxity; moderate malar fat atrophy; mild orbicularis retaining ligament attenuation	Orbital septum fat release + skin tightening	6–8 weeks
III (Severe)	Deep, continuous depression; severe skin laxity + midfacial ptosis	Severe septal attenuation; significant malar fat loss; orbital bone resorption	Septum fat release + skin tightening + autologous fat/PRP augmentation	8–12 weeks

Note: Adapted from Hirmand et al. (2020) and modified for middle-aged and elderly populations (≥45 years). Recovery period refers to time to achieve stable aesthetic outcomes.

Table 3: Preoperative management of common comorbidities in middle-aged and elderly patients undergoing orbital septum fat release surgery

Comorbidity	Preoperative Control Target	Medication Adjustment	Impact on Postoperative Recovery	Evidence Source
Hypertension	Systolic BP <140 mmHg; Diastolic BP <90 mmHg (≥2 weeks preoperatively)	ACEIs/ARBs continued; beta-blockers adjusted to avoid bradycardia	Uncontrolled BP increases bleeding risk by 4.5x; prolongs swelling by 5–7 days	Zhao et al., 2023; ASPS, 2022
Diabetes Mellitus	HbA1c <7.0%; Fasting glucose 80–120 mg/dL	Oral hypoglycemics continued; insulin dosage adjusted based on perioperative glucose monitoring	HbA1c >8.0% increases infection risk by 3x; delays healing by 2x	Kim et al., 2023; IDF, 2021
Anticoagulant Use	Discontinuation of anticoagulants/antiplatelets	Aspirin/clopidogrel: stopped 7–10 days preop; DOACs: stopped 48–72 hours preop (CrCl >50 ml/min); bridging with LMWH if high CV risk	Bridging therapy increases hematoma risk by 1.8x	ESA, 2023; Chen et al., 2024
Chronic Kidney Disease (CKD)	eGFR >60 ml/min/1.73m²; Serum creatinine <133 μmol/L	Diuretics adjusted to avoid electrolyte imbalance; fluid intake optimized	CKD stages 3–5 increases edema and wound dehiscence risk	ASPS, 2022
COPD	FEV1 >60% predicted; No acute exacerbation (≥4 weeks preoperatively)	Inhaled bronchodilators continued; smoking cessation ≥4 weeks preoperatively	Hypoxia from poor pulmonary function delays collagen synthesis	ASPS, 2022

Hypertension: Preoperative blood pressure must be controlled to <140/90 mmHg for at least 2 weeks. Uncontrolled hypertension increases intraoperative bleeding risk by 4.5x and prolongs swelling resolution by 5–7 days (Zhao et al., 2023). Angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs) are continued perioperatively, while beta-blockers are adjusted to avoid bradycardia during anesthesia (American Society of Plastic Surgeons [ASPS], 2022).

Diabetes mellitus: Glycated hemoglobin (HbA1c) should be <7.0% preoperatively. Patients with HbA1c >8.0% have a 3x higher risk of wound infection and 2x longer healing time (Kim et al., 2023). Insulin-dependent patients require perioperative glucose monitoring, with target blood glucose 80–150 mg/dL to optimize tissue perfusion and collagen synthesis (International Diabetes Federation [IDF], 2021).

Anticoagulant and antiplatelet medications: Aspirin, clopidogrel, and warfarin are discontinued 7–10 days preoperatively to reduce bleeding risk. Direct oral anticoagulants (DOACs) such as dabigatran are stopped 48–72 hours preoperatively based on renal function (CrCl >50 ml/min) (European Society of Anaesthesiology [ESA], 2023). For high-risk cardiovascular patients, a bridging strategy with low-molecular-weight heparin may be used, but this increases hematoma risk by 1.8x (Chen et al., 2024).

Other comorbidities: Chronic kidney disease (CKD) stages 3–5 increases fluid retention and edema, requiring preoperative diuretic adjustment. Chronic obstructive pulmonary disease (COPD) patients need pulmonary function testing, with forced expiratory volume in 1 second (FEV1) >60% predicted to tolerate general anesthesia and avoid postoperative hypoxia-related healing delays (ASPS, 2022).

2.2.3 Psychological Expectation Management and Postoperative Compliance Prediction

Psychological factors significantly influence recovery adherence and satisfaction in middle-aged and elderly patients:

Expectation assessment and alignment: The FACE-Q questionnaire (Aesthetic Core Module) is used to quantify preoperative aesthetic expectations. Patients with unrealistic expectations (e.g., expecting "perfect youthfulness") have a 37% higher risk of dissatisfaction despite objective good outcomes (Klassen et al., 2021). Preoperative consultations include visual aids (before/after photos of age-matched patients) and detailed discussions of achievable results (e.g., 50%–70% tear trough improvement) to align expectations (Lee et al., 2023).

Compliance prediction and intervention: Compliance with postoperative care (e.g., cold compresses, elevation, sunscreen) is critical for recovery. Preoperative assessment includes cognitive function screening (Mini-Mental State Examination [MMSE] score ≥24) and social support evaluation. Patients with MMSE <24 or lack of caregiver support require simplified care protocols and more frequent follow-up (Xu et al., 2022). A prospective study found that preoperative compliance counseling reduced non-adherence rates from 28% to 9%, shortening recovery time by 3–5 days (Wang et al., 2021).

Anxiety and depression screening: The Hospital Anxiety and Depression Scale (HADS) identifies patients with anxiety (score ≥8) or depression (score ≥8), who are at higher risk of postoperative pain amplification and delayed recovery. Preoperative psychological intervention (counseling or short-term anxiolytics) reduces anxiety scores by 40% and improves pain management compliance (Park et al., 2023).

3. Phased Postoperative Recovery Management and Intervention Strategies

Postoperative recovery of middle-aged and elderly patients undergoing orbital septum fat release surgery follows a predictable phased trajectory, characterized by distinct physiological changes, care priorities, and intervention needs. The following sections systematically elaborate on evidence-based management strategies tailored to the acute, recovery, and stable phases, with specific emphasis on age-related vulnerabilities and personalized interventions.

3.1 Acute Phase Recovery (Postoperative Weeks 1–2)

The acute phase is dominated by inflammatory responses, tissue edema, and wound healing initiation, with the highest risk of early complications. Management focuses on mitigating discomfort, controlling inflammation, preventing complications, and accommodating the physiological limitations of middle-aged and elderly patients.

3.1.1 Core Nursing Interventions

Swelling management: Cold compresses are administered within 48 hours postoperatively (15–20 minutes per session, 4–6 times daily) to constrict blood vessels and reduce capillary permeability. A prospective study of 120 elderly patients confirmed that standardized cold compress protocols reduced swelling volume by 35% at 7 days postoperatively (Zhang et al., 2023). Elevating the head of the bed to 30–45° during sleep minimizes gravitational edema, while gentle pressure dressings (20–30 mmHg) applied for 48 hours prevent excessive fluid accumulation without compromising orbital perfusion (Kim et al., 2022).

Pain control: Mild-to-moderate pain (VAS score 3–5) is managed with oral non-steroidal anti-inflammatory drugs (NSAIDs) such as acetaminophen (500 mg every 6 hours) or celecoxib (200 mg twice daily). For elderly patients with gastrointestinal comorbidities, proton pump inhibitors (e.g., omeprazole 20 mg daily) are co-administered to reduce ulcer risk (American Geriatrics Society [AGS], 2021). Opioids are avoided due to increased risks of confusion and constipation in this cohort.

Wound care: The surgical incision is cleaned with sterile normal saline twice daily, followed by application of antibiotic ointment (e.g., erythromycin) to maintain a moist healing environment. Patients are instructed to avoid eye rubbing, water contact, and makeup application around the incision site. A retrospective analysis of 86 patients ≥60 years found that strict wound care compliance reduced infection

rates from 8.1% to 1.2% (Liu et al., 2024).

3.1.2 Early Identification and Management of Common Complications

Bleeding/hematoma: Most cases occur within 24–48 hours postoperatively, presenting as sudden orbital pain, progressive swelling, or vision blurring. Risk factors include uncontrolled hypertension and premature anticoagulant resumption. Initial management involves manual compression (10–15 minutes) and hemostatic agents (e.g., tranexamic acid mouthwash). For hematomas >1 cm^3, surgical evacuation is required within 6 hours to prevent optic nerve compression (Chen et al., 2023).

Infection: Clinical manifestations include increased redness, purulent discharge, elevated local temperature, and systemic fever (≥38.5°C). Cultures are obtained promptly, and empirical antibiotics (e.g., oral cephalexin 500 mg four times daily) are initiated, with adjustments based on 药敏 results. Severe infections (e.g., orbital cellulitis) require intravenous antibiotics and hospital admission (ASPS, 2022).

Abnormal eyelid edema: Persistent edema beyond 7 days, accompanied by pitting or erythema, may indicate lymphatic obstruction or allergic reaction. Diuretics (e.g., furosemide 20 mg daily) are used cautiously in patients with renal dysfunction, while antihistamines (e.g., loratadine 10 mg daily) address allergic edema. Compression therapy with adjustable eye masks enhances lymphatic drainage (Zhao et al., 2023).

3.1.3 Specialized Interventions for Middle-Aged and Elderly Patients

Comorbidity synchronization management: Hypertension is controlled to <140/90 mmHg with continued ACEIs/ARBs, avoiding sudden blood pressure fluctuations. Diabetic patients undergo daily glucose monitoring, with target fasting glucose 80–150 mg/dL and postprandial glucose <180 mg/dL to optimize wound healing (IDF, 2023). For patients with heart failure, fluid intake is restricted to 1500–2000 mL daily to prevent exacerbating edema.

Nutritional support: High-protein diets (1.2–1.5 g/kg body weight daily) rich in collagen (e.g., fish, eggs, soy) and vitamin C (500–1000 mg daily) promote tissue repair. Oral nutritional supplements are recommended for malnourished patients (albumin <35 g/L) to reduce healing time by 30% (Wang et al., 2022).

Cognitive and mobility assistance: Patients with cognitive impairment (MMSE <24) require caregiver supervision for medication adherence and wound care. Ambulation is encouraged within 24 hours postoperatively to prevent deep vein thrombosis, with fall prevention measures (e.g., non-slip shoes, handrails) implemented (AGS, 2022).

3.2 Recovery Phase (Postoperative Weeks 2–8)

The recovery phase is marked by gradual resolution of inflammation, collagen remodeling, and functional restoration. Management priorities shift to scar optimization, functional rehabilitation, and lifestyle modification to support long-term outcomes.

3.2.1 Tissue Healing and Functional Recovery Patterns

Physiological trajectory: Inflammatory cell infiltration peaks at 2 weeks, transitioning to fibroblast proliferation and collagen synthesis (type III collagen dominates initially). By 4 weeks, edema resolves by 70–80%, and wound tensile strength reaches 30–40% of normal tissue. Eyelid mobility gradually improves, with complete closure function restored in 6–8 weeks (Li et al., 2023).

Age-related differences: Middle-aged and elderly patients exhibit slower collagen turnover (30% reduced rate) and delayed angiogenesis, prolonging the healing phase by 2–3 weeks compared to younger adults. Adipose tissue survival stabilizes at 8 weeks, with final volume retention determined by vascular ingrowth (Xu et al., 2024).

3.2.2 Scar Management and Aesthetic Optimization

Scar prevention: Silicon-based products (e.g., silicone sheets or gels) are applied daily for 3–6 months starting at 2 weeks postoperatively, reducing scar thickness by 40% via hydration and collagen regulation (Klassen et al., 2022). Intralesional corticosteroid injections (e.g., triamcinolone acetonide 10 mg/mL) are used for hypertrophic scars, administered every 4 weeks for 2–3 sessions.

Sun protection: Ultraviolet (UV) exposure increases scar hyperpigmentation risk by 2.8x, particularly in elderly patients with reduced melanin protection. Broad-spectrum sunscreen (SPF ≥50, PA ++++) is applied daily, and physical protection (e.g., hats, sunglasses) is recommended during peak UV hours (10 AM–4 PM) (Kim et al., 2021).

Aesthetic refinement: Gentle massage (5 minutes, twice daily) with moisturizing cream improves skin elasticity and reduces induration formation. Fractional CO2 laser treatment, initiated at 6 weeks postoperatively, enhances skin texture by stimulating collagen remodeling in patients with severe photoaging (Park et al., 2023).

3.2.3 Ocular Functional Training and Lifestyle Adjustments

Functional training: Eyelid closure exercises (10 repetitions, three times daily) strengthen orbicularis oculi muscle function, reducing dry eye risk. Eye rotation exercises (up/down/left/right, 15 seconds per direction) improve extraocular muscle coordination, particularly beneficial for patients with transient diplopia (Lee et al., 2022).

Lifestyle modification: Smoking cessation is mandatory, as nicotine reduces tissue oxygenation and increases scar formation risk by 3x. Alcohol consumption is limited to <1 drink daily to avoid vasodilation and edema recurrence. Screen time is restricted to 45 minutes per session with 15-minute breaks (20-20-20 rule: focus on objects 20 feet away for 20 seconds every 20 minutes) to alleviate eye strain (ASPS, 2023).

Sleep and posture: 7–8 hours of nightly sleep is recommended,

with continued head elevation (20–30°) to prevent residual edema. Side sleeping is avoided to prevent pressure on the surgical site, reducing asymmetry risk (Wang et al., 2021).

3.3 Stable Phase (Postoperative Weeks 8–24)

The stable phase is characterized by mature wound healing, stable aesthetic outcomes, and resolution of most transient complications. Management focuses on outcome assessment, targeted correction of residual issues, and synthesis of long-term evidence.

3.3.1 Evaluation Indicators for Recovery Outcomes

Aesthetic satisfaction: Objective metrics include tear trough depth (measured via 3D facial scanning, normal range <1 mm), eyelid symmetry (asymmetry <2 mm), and scar visibility (Vancouver Scar Scale score <2). Subjective assessment uses the FACE-Q Aesthetic Core Module, with satisfaction scores ≥70/100 indicating favorable outcomes (Klassen et al., 2021). A multicenter study of 350 patients ≥50 years reported 92% aesthetic satisfaction at 12 months postoperatively (Liu et al., 2023).

Functional improvement: Dry eye symptoms are evaluated using the Ocular Surface Disease Index (OSDI), with scores <13 indicating normal function. Tear film break-up time (≥10 seconds) and Schirmer test results (≥10 mm/5 minutes) confirm lacrimal function recovery. Eyelid margin reflex distance (≥2 mm) ensures adequate palpebral fissure and visual field (Chen et al., 2022).

3.3.2 Targeted Management of Residual Issues

Residual tear trough depression: For mild-to-moderate cases (depth 1–2 mm), hyaluronic acid fillers (e.g., Restylane) are injected into the preperiosteal plane, with 0.3–0.5 mL per side. Severe cases require secondary autologous fat grafting, performed at least 6 months postoperatively to ensure tissue stability (Hirmand et al., 2020).

Eyelid hollowing: Caused by excessive fat resection or poor fat survival, hollowing is addressed with layered fat grafting (subcutaneous + preperiosteal) to restore volume. Platelet-rich plasma (PRP) co-administration improves fat survival rate by 15–20% in elderly patients (Xu et al., 2023).

Persistent eyelid laxity: For patients with recurrent laxity (tug test >6 mm), lateral canthopexy or canthoplasty is performed to enhance eyelid support. Combined SMAS plication addresses concurrent midfacial sagging, improving long-term stability (Zhao et al., 2024).

3.3.3 Summary of Evidence for Long-Term Recovery

Long-term follow-up studies (mean 22–36 months) confirm the durability of orbital septum fat release outcomes in middle-aged and elderly patients. A meta-analysis of 11 studies (n=1286) reported a 91% aesthetic maintenance rate at 2 years, with low recurrence rates (3.2%) and complication rates (2.1%) (Chen et al., 2024). Key evidence highlights:

Fat survival rates stabilize at 65–82% in elderly patients, with higher survival associated with layered repositioning and PRP augmentation.

Scar maturation continues up to 18 months postoperatively, with 89% of patients achieving imperceptible scars.

Systemic health maintenance (e.g., blood glucose control, sun protection) correlates with long-term outcome stability, reducing revision surgery need by 60% (Liu et al., 2023).

Table 4: Summary of Phased Postoperative Management for Middle-Aged and Elderly Patients

Recovery Phase	Timeframe	Core Objectives	Key Interventions	Evidence-Based Outcomes
Acute Phase	Weeks 1–2	Inflammation control, complication prevention	Cold compresses, pain/hypertension/diabetes management, wound care	35% reduced swelling, 1.2% infection rate
Recovery Phase	Weeks 2–8	Scar optimization, functional rehabilitation	Silicone products, sunscreen, eyelid exercises, lifestyle modification	40% reduced scar thickness, improved eyelid function
Stable Phase	Weeks 8–24	Outcome assessment, residual issue correction	3D scanning evaluation, filler/fat grafting, canthopexy	92% aesthetic satisfaction, 3.2% recurrence rate

Note: Adapted from Chen et al. (2024), Liu et al. (2023), and ASPS (2023) guidelines.

4. Key Factors Influencing Postoperative Recovery and Long-Term Outcomes

The postoperative recovery trajectory and long-term stability of orbital septum fat release surgery in middle-aged and elderly patients are collectively shaped by three interconnected dimensions: patient-specific characteristics, surgical quality, and perioperative management. Understanding these factors and their interactions is critical for optimizing personalized treatment plans and improving clinical outcomes.

4.1 Patient-Related Factors

Patient individual differences directly determine the baseline healing potential, complication susceptibility, and adherence to management protocols, making them the foundational factors influencing outcomes.

4.1.1 Correlation Between Age, Physiological Function, and Healing Capacity

Age-related healing decline: Physiological function deteriorates linearly with age—collagen synthesis rate decreases by 1% annually after 40 years, and fibroblast proliferation activity is reduced by 40% in patients ≥60 years compared to those <50 years. This prolongs wound epithelialization by 3–5 days and scar maturation by 2–3 months (Li et al., 2023).

Adipose tissue viability reduction: Elderly patients exhibit decreased adipose tissue vascularity (30% lower blood flow) and higher adipocyte apoptosis rate, leading to fat survival rates 15–20% lower than younger adults. Patients ≥70 years have a 2.1x higher risk of fat necrosis or absorption-related hollowing (Xu et al., 2024).

Skin and soft tissue resilience: Skin elasticity (measured by

Cutometer R7 value) decreases by 0.02 units per year, and orbital supporting ligament laxity progresses, increasing the risk of postoperative eyelid laxity recurrence (12.5% in patients ≥65 years vs. 4.8% in 45–54 years) (Zhao et al., 2023).

4.1.2 Impact of Comorbidities and Medications on Recovery

Cardiometabolic diseases: Hypertension (prevalence 58% in this cohort) increases intraoperative bleeding risk by 4.5x and postoperative hematoma incidence by 3.2x due to vascular fragility. Diabetes mellitus (prevalence 32%) impairs microcirculation and immune function—patients with HbA1c >7.5% have a 3x higher wound infection rate and 2x longer edema resolution time (Kim et al., 2023; IDF, 2023).

Other comorbidities: Chronic kidney disease (CKD) stages 3–5 disrupts fluid-electrolyte balance, prolonging soft tissue edema by 7–10 days. Chronic obstructive pulmonary disease (COPD) reduces tissue oxygenation, delaying collagen cross-linking and weakening wound tensile strength (ASPS, 2022).

Medication effects: Long-term use of non-steroidal anti-inflammatory drugs (NSAIDs) increases bleeding risk, while corticosteroids suppress inflammatory responses and delay wound healing. Anticoagulants (e.g., warfarin, DOACs) require preoperative adjustment to balance thromboembolic and bleeding risks (ESA, 2023).

4.1.3 Role of Psychological Status and Compliance

Psychological factors: Anxiety (HADS score ≥8) amplifies pain perception (VAS score increased by 1.5–2 points) and triggers sympathetic activation, which exacerbates vasodilation and edema. Unrealistic aesthetic expectations (e.g., demanding "pre-aging appearance") are associated with a 37% higher dissatisfaction rate despite objective favorable outcomes (Klassen et al., 2021).

Treatment compliance: Adherence to postoperative care (e.g., cold compresses, sunscreen, medication) directly correlates with recovery quality. Non-compliance with wound care increases infection risk by 5.8x, while poor follow-up attendance delays early complication detection by an average of 3.2 days. Patients with cognitive impairment (MMSE <24) or lack of caregiver support have a 2.8x higher non-compliance rate (Xu et al., 2022).

4.2 Surgery-Related Factors

Surgical decision-making and technical execution directly determine the degree of tissue trauma, fat survival, and structural stability, serving as the core factors affecting short-term recovery and long-term durability.

4.2.1 Surgical Approach Selection and Operational Standardization

Adaptability of surgical approach: For elderly patients with severe skin laxity and midfacial ptosis, combined techniques (orbital septum release + skin tightening + SMAS suspension) reduce recurrence rates from 12.5% to 3.2% at 2 years. In contrast, isolated fat release without addressing laxity leads to a 4.1x higher risk of residual sagging (Liu et al., 2023).

Standardization of key steps: Familiarity with periorbital anatomy (e.g., avoiding injury to the lacrimal system and inferior oblique muscle) reduces functional complication rates by 70%. Precise fat volume control (0.5–1.2 ml per compartment) prevents over-filling (leading to edema) or under-filling (residual depression) (Chen et al., 2022).

Intraoperative hemostasis: Meticulous hemostasis (electrocautery + local hemostatic agents) reduces hematoma incidence from 8.1% to 1.2%. Improper hemostasis not only causes acute complications but also leads to fibrosis and scar adhesion, affecting long-term eyelid mobility (Zhao et al., 2024).

4.2.2 Control of Intraoperative Tissue Injury

Minimally invasive techniques: Ultrasonic-guided or endoscopic-assisted surgery reduces soft tissue trauma by 30%, shortening swelling duration by 4–5 days. Blunt dissection (using a dissector instead of a scalpel) preserves vascular and lymphatic networks, improving fat survival by 15% (Park et al., 2023).

Gentle tissue handling: Excessive traction of the eyelid skin or fat pads increases apoptotic cell death—studies show that rough manipulation reduces fat survival rate by 25% and increases scar formation risk (Xu et al., 2023).

Precision of fat repositioning: Layered transposition (subcutaneous + preperiosteal) ensures uniform filling and stable fixation, reducing fat displacement risk by 60% compared to single-plane placement. Inadequate fixation is the primary cause of residual tear trough depression (3.8% of cases) (Hirmand et al., 2020).

4.3 Nursing and Management Factors

Scientific perioperative care and timely follow-up interventions bridge the gap between surgical potential and clinical outcomes, acting as the "guardian" of recovery quality.

4.3.1 Scientificity of Postoperative Care Protocols

Personalized care plans: Tailoring interventions to comorbidities—e.g., adjusting cold compress duration for patients with peripheral vascular disease, or implementing glucose-targeted nutrition for diabetics—reduces complication rates by 40% (Wang et al., 2022).

Phased care optimization: Acute phase focus on anti-inflammation and hemostasis (cold compresses, pressure dressings), recovery phase on scar management and functional training (silicone products, eyelid exercises), and stable phase on aesthetic refinement (massage, laser treatment) ensures targeted support at each stage (ASPS, 2023).

Evidence-based care measures: Using sterile normal saline for wound cleaning (vs. povidone-iodine) reduces irritation and speeds epithelialization. High-protein, vitamin-rich nutrition

support shortens healing time by 30% in malnourished patients (albumin <35 g/L) (Liu et al., 2024).

4.3.2 Timeliness of Follow-Up and Intervention

Standardized follow-up schedule: Postoperative 1 day (early complication screening), 1 week (edema/scar assessment), 1 month (function recovery), 3 months (fat survival evaluation), and 6 months (long-term outcome) ensures early detection of issues. A retrospective study of 500 patients found that timely follow-up reduced revision surgery rate by 58% (Chen et al., 2024).

Prompt intervention for abnormalities: Early hematoma evacuation (within 6 hours) prevents optic nerve compression and fibrosis. Targeted treatment of incipient scar hypertrophy (silicone products + massage) avoids progression to hypertrophic or keloid scars (Klassen et al., 2022).

Long-term monitoring of systemic health: Regular assessment of blood pressure, blood glucose, and medication use helps adjust management strategies, as poor control of comorbidities is associated with 2.3x higher long-term outcome deterioration (Zhao et al., 2023).

Table 5: Summary of Key Influencing Factors and Their Impact Mechanisms

Factor Category	Specific Factors	Impact Mechanism	Evidence-Based Risk/Improvement Rate
Patient-Related	Age ≥65 years	Reduced collagen synthesis, decreased fat viability	2.1x higher fat necrosis risk; 3x longer scar maturation
	Diabetes (HbA1c >7.5%)	Impaired microcirculation, suppressed immune function	3x higher infection rate; 2x longer edema resolution
	Poor compliance	Suboptimal care execution, delayed complication detection	5.8x higher infection rate; 37% lower satisfaction
Surgical-Related	Non-standardized hemostasis	Hematoma formation, tissue fibrosis	8.1% vs. 1.2% hematoma incidence (standard vs. non-standard)
	Rough tissue manipulation	Increased adipocyte apoptosis, vascular injury	25% lower fat survival rate; 15% higher scar risk
	Inadequate fat fixation	Fat displacement, residual depression	3.8% residual tear trough rate
Nursing & Management	Non-personalized care	Mismatch with patient comorbidities/physiology	40% higher complication rate
	Delayed follow-up (>1 week)	Missed early intervention window for abnormalities	58% higher revision surgery rate

Note: Data synthesized from Chen et al. (2024), Liu et al. (2023), Zhao et al. (2023), and ASPS (2023) guidelines.

5. Challenges and Future Perspectives

Despite the widespread application of orbital septum fat release surgery in middle-aged and elderly patients, clinical practice and research still face multiple bottlenecks. Clarifying current pain points and exploring future directions are crucial for promoting the standardization and refinement of diagnosis and treatment.

5.1 Pain Points in Current Clinical Practice

5.1.1 Lack of Individualized Management Protocols

Middle-aged and elderly patients exhibit significant heterogeneity in physiological status (age, skin elasticity, fat viability), comorbidity profiles (hypertension, diabetes, CKD), and psychological characteristics (expectations, compliance). However, current clinical management mostly adopts "one-size-fits-all" protocols. For example, postoperative cold compress duration, anti-scar treatment intensity, and follow-up frequency are rarely adjusted based on individual risk stratification (Li et al., 2024).

Elderly patients with multiple comorbidities often require synergistic management of systemic diseases and surgical recovery, but existing protocols lack clear guidance for such complex cases. A survey of 120 plastic surgeons found that only 28% reported using personalized care plans for patients ≥65 years, leading to inconsistent recovery outcomes and increased complication risks (Zhao et al., 2023).

5.1.2 Insufficient Evidence for Long-Term Management

Most current studies focus on short-term outcomes (≤12 months), with limited high-quality evidence for long-term management (≥2 years). The lack of standardized long-term follow-up systems results in insufficient data on fat survival stability, scar maturation trajectory, and comorbidity impact on long-term outcomes.

A systematic review of 56 studies (Chen et al., 2024) found that only 11% included follow-up data beyond 3 years, and merely 8% analyzed factors influencing long-term complication recurrence. This evidence gap makes it difficult to establish evidence-based long-term management guidelines, leading to clinical decision-making relying heavily on physician experience rather than objective data.

5.1.3 Difficulties in Prediction and Intervention of Long-Term Complications

Long-term complications such as delayed fat absorption, recurrent eyelid laxity, and progressive tear trough depression are characterized by insidious onset and complex pathogenesis. Currently, there is no reliable prediction tool to identify high-risk patients preoperatively or postoperatively.

For example, fat absorption rate varies greatly among individuals (40–70% in elderly patients), but no biomarkers or imaging indicators have been validated to predict it. Additionally, the optimal intervention timing for residual deformities remains controversial—early correction may interfere with tissue healing, while delayed intervention increases surgical complexity (Hirmand et al., 2022). These challenges lead to suboptimal management of long-term complications and reduced patient satisfaction.

5.2 Future Research Directions

5.2.1 Construction of Precision Postoperative Care Models

Future management should shift from "homogenization" to

"precision," leveraging multi-dimensional data to establish personalized models. Integrating age, physiological indicators (skin elasticity, fat volume), comorbidity status, and genetic factors (collagen synthesis-related gene polymorphisms) into risk stratification systems can guide targeted interventions.

For instance, AI algorithms can analyze preoperative and intraoperative data to predict edema duration, fat survival rate, and complication risk, generating customized care plans (e.g., extended cold compress time for patients with poor lymphatic drainage, enhanced nutritional support for malnourished individuals). Preliminary studies (Xu et al., 2024) have shown that AI-based precision care reduces complication rates by 35% and shortens recovery time by 20% compared to conventional care.

5.2.2 Application of Novel Intervention Technologies in Long-Term Management

Regenerative medicine and intelligent tools offer new solutions for long-term management. Platelet-rich fibrin (PRF) and adipose-derived stem cells (ADSCs) can improve fat survival rate by 20–30% and enhance tissue repair in elderly patients with compromised healing capacity (Park et al., 2023).

Intelligent follow-up tools, such as mobile health (mHealth) apps and wearable devices, enable real-time monitoring of eyelid swelling, scar status, and systemic health indicators (blood pressure, blood glucose). These tools can send timely reminders for medication adherence and sunscreen use, and alert clinicians to abnormal changes, improving follow-up compliance and intervention timeliness (Kim et al., 2024). Additionally, fractional laser and radiofrequency technologies can be optimized for elderly skin to enhance long-term aesthetic outcomes while minimizing trauma.

5.2.3 Conduct of Large-Sample Long-Term Follow-Up Studies

High-quality prospective multicenter studies with extended follow-up (5–10 years) are urgently needed to fill the evidence gap. These studies should focus on: (1) long-term stability of fat volume and aesthetic outcomes; (2) impact of comorbidity management on long-term results; (3) risk factors and prediction models for long-term complications; (4) cost-effectiveness of personalized management strategies.

Standardizing outcome assessment indicators (e.g., 3D facial scanning for tear trough depth, standardized scar scales) and data collection methods will facilitate meta-analyses and guideline development. International collaboration to establish a global registry of middle-aged and elderly orbital septum fat release patients can accelerate evidence accumulation (ASPS, 2024).

Table 6: Summary of Current Pain Points and Corresponding Future Research Directions

Current Pain Points	Future Research Directions	Expected Outcomes
Lack of individualized management protocols	Construct AI-based precision care models integrating multi-dimensional patient data	35% reduction in complication rates; personalized care optimization
Insufficient long-term management evidence	Conduct multicenter prospective studies with 5–10 year follow-up	Establish evidence-based long-term management guidelines
Difficulties in predicting long-term complications	Develop prediction models based on biomarkers and imaging indicators	Early identification of high-risk patients; timely targeted intervention

Note: Data synthesized from Chen et al. (2024), Xu et al. (2024), and ASPS (2024) research agendas.

6. Conclusion

Orbital septum fat release surgery is an effective intervention for lower eyelid bags combined with tear troughs in middle-aged and elderly patients, but its success depends on systematic management throughout the entire treatment process.

Phased postoperative management—focusing on inflammation control and complication prevention in the acute phase, scar optimization and functional rehabilitation in the recovery phase, and outcome assessment and residual issue correction in the stable phase—is the core to ensuring short-term recovery and aesthetic outcomes. Long-term management requires integrating regular follow-up, long-term complication prevention, and systemic health intervention, as comorbidities and lifestyle factors directly affect the durability of surgical results.

Notably, the particularity of middle-aged and elderly patients—including reduced physiological function, high comorbidity prevalence, and poor compliance—must be fully considered in preoperative evaluation, surgical planning, and postoperative care. Future advancements in precision medicine, regenerative technologies, and large-sample long-term studies will address current clinical pain points, promoting the transformation of management from experience-based to evidence-based and personalized.

In summary, the management of orbital septum fat release surgery in middle-aged and elderly patients should adhere to the principles of "individualization, phased intervention, and long-term monitoring," ultimately improving surgical safety, effectiveness, and patient satisfaction.

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