

Clinical Outcomes and Complications of Fat Repositioning Technique for Tear Trough Deformity

Ahmed Ali Abulfadl Khashaba, Ayman Fikry Khalil, Moatasem Hussein Hussein Samaha

Department of Plastic and Reconstructive Surgery, Faculty of Medicine, Zagazig University, Egypt

*Corresponding author: Moatasem Hussein Hussein Samaha

E-mail: Moatasemsamaha@gmail.com

Abstract: The tear trough deformity is a common aesthetic concern, characterized by a hollowing or shadowing under the lower eyelid that gives a tired or aged appearance. It typically results from age-related anatomical changes, including volume loss, descent of the orbital fat pads, and weakening of the orbicularis retaining ligament. Tear troughs may also be present congenitally or appear early in life due to hereditary factors. Fat repositioning, also referred to as transposition or redraping of the lower eyelid fat, has emerged as a preferred surgical technique for correcting this deformity, especially in patients with herniated orbital fat and midface volume loss. Unlike traditional lower blepharoplasty, which involves excision of fat pads, fat repositioning conserves and redistributes the existing orbital fat to fill the tear trough and nasojugal groove, providing a more natural and youthful contour to the midface. Over the years, various surgical approaches to fat repositioning have been developed, including transconjunctival and transcutaneous techniques, with or without the use of supporting structures such as fascia or septal flaps. While fat repositioning has shown favorable aesthetic outcomes and high patient satisfaction, it is not without complications. Reported risks include ectropion, lower eyelid retraction, contour irregularities, asymmetry, hematoma, chemosis, and transient or persistent edema. The clinical outcomes and safety profile of fat repositioning techniques depend on multiple factors such as surgeon experience, patient anatomy, surgical approach, and postoperative care. Given the growing popularity of this technique in aesthetic and reconstructive oculoplastic surgery, it is important to evaluate both its efficacy and potential complications systematically.

Keywords: Fat, Repositioning, Tear Trough Deformity.

Introduction:

One of the primary motivations for fat repositioning is its versatility and capacity to yield natural, enduring results. For instance, in gluteal reshaping, studies report positive outcomes with an average increase in hip circumference and high patient satisfaction rates. In one study, patients reported a mean increase of 4.045 cm in hip circumference, with 65% satisfaction, illustrating the method's effectiveness in contour enhancement with minimal complications, such as an occasional oily cyst that can typically be surgically excised (1).

For facial contouring and restoration, fat grafting is valued for its safety and low complication rates. Studies reveal that facial contouring with autologous fat transfer effectively enhances soft tissue volume and smooths facial defects, although results vary with patient satisfaction, as fat resorption can occur over time, sometimes necessitating repeat procedures (2).

In addition to facial and gluteal contouring, autologous fat grafting is used in procedures like hand rejuvenation, where the long-term stability of fat grafts significantly improves aesthetic outcomes by reducing vein prominence and deepening metacarpal spaces. Studies comparing centrifuged and non-centrifuged fat for

hand augmentation highlight centrifuged fat's superior longevity and patient preference due to enhanced volume retention and reduced visible aging (3).

Clinical Outcomes of Fat Repositioning Technique

Clinical outcomes of fat repositioning techniques, particularly autologous fat grafting, vary based on factors like the technique, processing, and the area treated. Studies indicate that fat repositioning can significantly improve contour and volume in areas like the gluteal region, face, and extremities. For instance, condensed fat grafting has shown a higher retention rate, maintaining around 55% of grafted volume after 12 weeks compared to traditional fat grafts (4).

For facial contouring, autologous fat grafting is generally effective, although long-term results can be unpredictable due to fat resorption, necessitating possible revision treatments for enhanced outcomes (2). In cryopreserved fat grafts, clinical outcomes show that while the procedure is safe, volume maintenance tends to be lower than fresh fat grafts, highlighting a challenge in long-term retention (5).

Patient satisfaction rates tend to be high with these methods, particularly when using techniques like centrifugation, which improves longevity and aesthetic results, especially in applications like hand rejuvenation (3). However, some patients experience fat necrosis, emphasizing the importance of careful procedural planning and fat processing to optimize graft viability (6).

Overall, fat repositioning provides effective results in various applications, but outcomes depend significantly on procedural precision and individualized planning to accommodate variations in fat resorption and graft longevity.

Aesthetic Outcomes and Patient Satisfaction

Clinical studies on fat repositioning techniques indicate high levels of patient satisfaction and effective aesthetic outcomes across various applications. Transconjunctival fat removal combined with resected fat grafting, for example, has achieved a 97.8% satisfaction rate, effectively addressing lower eyelid concerns with minimal complications (7).

In facial volume restoration, the Fat Autograft Muscle Injection (F.A.M.I.) technique also demonstrates long-term symmetry and improved aesthetics, with high satisfaction among patients seeking subtle, natural-looking enhancements (8).

For midface augmentation, autologous fat grafting offers predictable volume restoration, enhancing facial definition and rejuvenation, especially in patients with lower body fat or smaller skull structures (9). Techniques like targeted fat grafting in temporal hollowing have yielded a 91.7% satisfaction rate with over 65% fat retention, which further underscores the value of precise volume restoration for facial aesthetics (10).

While patient satisfaction is generally high, outcomes can vary with fat graft survival and resorption rates. Enhanced approaches, such as integrating adipose-derived stem cells, have shown to improve graft longevity and aesthetic satisfaction (11).

Long-Term Results and Stability of Repositioned Fat

Long-term results and stability of repositioned fat grafts depend significantly on processing methods and procedural specifics. Studies reveal that processing techniques, such as using the Revolve system, yield higher retention rates, with fat grafts retaining up to 73.2% of their volume compared to 37.5% in decanted samples, suggesting that effective processing contributes to sustained volume retention and improved graft viability (12).

Mechanical methods to condense low-density fat also enhance stability, showing a 55% retention rate at 12 weeks post-transplantation, which is higher than that achieved with standard low-density fat (4). Similarly, centrifugation has been shown to improve longevity, with patients expressing a preference for centrifuged fat in hand augmentation due to its better retention at the 5-month evaluation (3).

However, long-term freezing of fat grafts may reduce stability and viability. Fat stored for 7 months exhibits diminished histological integrity and volume maintenance, underscoring the need for optimal storage

techniques when preservation is necessary (13). Furthermore, studies suggest that cannula diameter affects long-term graft outcomes, as larger cannulas improve fat retention but may risk forming cystic nodules due to lower pressure and velocity during injection (14).

Complications and Challenges in Fat Repositioning for Tear Trough Deformity

While there are several options for surgical correction of the tear trough deformity, as described, all can be successful in the right hands. Each technique has a learning curve, and each has its own advantages and disadvantages. All of these techniques should be considered more advanced and complex procedures, beyond the scope of traditional blepharoplasty alone and with longer recovery periods. All the techniques listed have potential for complications, and surgeons are advised to proceed with caution, as improper technique and patient selection can lead to poor results and complications. What follows is a list of common complications. (15)

Chemosis is often reported, due to a combination of postoperative periorbital lymphatic obstruction and dryness of the conjunctiva. Mild to moderate chemosis is often successfully treated with anti-inflammatory and steroid eye drops and ointment. Some patients may benefit from patching the eye closed to prevent exposure. Severe chemosis can be treated with the addition of conjunctivotomy and vasoconstrictive eye drops. Persistent chemosis is often caused by lid malposition, which must be treated to correct the chemosis. (16)

Lid malposition can range from minimal scleral show to ectropion, and it may occur as a result of either transcutaneous or transconjunctival approaches. Scleral show can often be corrected conservatively with early postoperative lid massage and taping. Postoperative ectropion should be classified as either early (**first postoperative week**) or late (**first postoperative month**). Early ectropion is the result of canthopexy/canthoplasty fixation failure, and treatment requires early surgical correction. Late ectropion will usually present with gradual worsening over the course of the first or second month postoperatively and is a result of anterior or posterior lamellar scarring. The level of scarring can be evaluated by attempting to manipulate the lower lid with the examiners finger. (17)

If the lower lid can be elevated and is mobile, the scar ring is within the anterior lamella. However, if the lower lid cannot be manually elevated and is fixed to the orbital rim, the scarring is within the posterior lamella. Treatment of late ectropion should initially start with a trial of six to eight weeks of conservative management. However, if the ectropion persists, anterior lamellar scarring should be surgically resected, and posterior lamellar scarring often requires the addition of a spacer graft. (18)

Overdissection in the nasojugal area should be avoided and may result in injury to the buccal branch of the facial nerve. This can result in difficulties with blinking and eyelid closure or decreased tone of the lower lid, and it may affect the eyelid pumping mechanism for the lacrimal apparatus. (19)

Persistent dark circles from periorbital hyperpigmentation are best treated with topical skin care, such as hydroquinone. (20)

Postoperative edema and ecchymosis are to be expected in the early postoperative period. Additional dissection and manipulation of the tear trough may result in more substantial areas of ecchymosis and edema than those seen with less extensive blepharoplasty procedures. The patient should be informed of this possibility preoperatively. While the edema and ecchymosis will resolve with out treatment, supportive care in the early postoperative period with ice packs, head-of-bed elevation, abstinence from salty foods and alcohol, and avoidance of strenuous activity is advised. The authors also recommend a regimen of preoperative and postoperative oral supplements Arnica montana and bromelain. (21)

Complications of Fat Repositioning

Despite these successes, fat repositioning carries risks, especially when factors like fat handling, grafting technique, and postoperative care are not meticulously managed. One complication associated with fat repositioning is fat hypertrophy or overgrowth, which can lead to both aesthetic and functional challenges. For example, hypertrophy can occur postoperatively as a painless mass that may necessitate additional interventions, such as liposuction, to correct the abnormal fat growth (22).

Cryopreservation is another area of concern. Fat grafts preserved by freezing for extended periods tend to show diminished viability and quality, with inferior histological integrity and reduced weight. Long-term freezing of fat reduces its clinical efficacy, prompting recommendations against using frozen fat for extended periods (13).

In terms of safety, studies highlight that while autologous fat grafting has a generally low complication rate, rare but serious risks remain. These include the possibility of fat embolism and intraarterial fat injection, which can lead to severe, sometimes fatal, consequences. Using advanced lipofilling techniques, such as expansion vibration lipofilling, can mitigate some of these risks by improving cannula tip control and enhancing fat distribution, but requires careful execution and training (23).

Fat Viability and Retention

The retention rate of fat grafts is a critical determinant of success in fat repositioning. Achieving optimal graft retention hinges on factors like the preparation of fat tissue, injection technique, and the anatomical site receiving the graft. Fat retention rates vary, and fat resorption remains a common issue, necessitating possible repeat procedures to maintain desired outcomes. Studies suggest that handling techniques, including centrifugation, can improve the longevity of fat grafts by enhancing cell viability and decreasing volume loss (24).

However, not all methods yield consistent long-term retention. For instance, a study of cryopreserved fat used for injection found that while patients experienced satisfactory results, maintaining graft volume over time was challenging, indicating a need for refinement in fat handling and injection methods (5).

Risks of Lower Eyelid Retraction and Asymmetry

Lower eyelid retraction and asymmetry are potential complications following various cosmetic and reconstructive eyelid surgeries. Causes of lower eyelid retraction include factors like midface descent, scarring, and preexisting eyelid laxity, leading to conditions such as scleral show, canthal laxity, and ocular irritation. Proper surgical techniques and preoperative evaluations are essential to mitigate these risks, especially for patients with prominent globes or inherent lower eyelid laxity (25).

Surgical approach plays a critical role in risk management. For instance, transconjunctival blepharoplasty generally has a lower risk of retraction compared to transcutaneous methods, which may increase complications due to tissue disruption and scarring. Additional factors such as surgical technique, especially in procedures like large inferior rectus recession for strabismus, can further heighten the risk of retraction (26).

Advanced techniques have shown success in reducing retraction and asymmetry risks. Composite septo-retractor recession, for example, has improved lower eyelid position and contour, while reducing lateral asymmetry, by adjusting retractor muscle tension and thereby enhancing stability (27). Similarly, procedures like the lateral tarsoconjunctival onlay flap effectively address multi-vector retraction, improving both functional and aesthetic outcomes with minimal complications (28).

Common Complications: Motility Disturbances and Downtime

Common complications associated with fat repositioning techniques include motility disturbances, downtime, and issues with fat viability. While fat graft retention is crucial for effective outcomes, it can be influenced by factors like cannula size and handling techniques. For instance, larger cannulas can improve fat retention but may result in complications such as oil cystic nodules, potentially impacting recovery time and increasing downtime (14).

Expansion vibration lipofilling has been introduced as a method to reduce fat embolism risks by enhancing cannula tip control, which is important in minimizing downtime and ensuring smooth recovery. This technique also reduces the effort required by the surgeon, allowing for a more controlled procedure that mitigates common issues like extended operating times and tedious fat transfers (23).

Handling and preparation are pivotal in autologous fat grafting, as improper techniques can lead to decreased fat viability, resulting in suboptimal outcomes and potential reoperations. Attention to fat graft handling

protocols can help avoid poor graft survival, ensuring that the repositioned fat maintains its volume and shape over time (24).

Learning Curve and Technical Expertise Required

The learning curve for the fat repositioning technique, particularly in lower eyelid and transconjunctival procedures, requires specialized skills and technical precision. Internal fixation methods for transconjunctival fat repositioning are notably challenging due to the narrow operational field, demanding advanced expertise and familiarity with tools like Chang's needle to achieve effective internal fixation. This approach has a steeper learning curve compared to externalized percutaneous sutures, which are more commonly used due to their relative ease (29).

In broader fat grafting applications, successful outcomes also depend on a surgeon's knowledge of anatomy and technique. For instance, intramuscular injection is preferred for fat repositioning in buttock enhancement, as it increases fat graft survival. This requires precise injection skills and an understanding of how fat behaves in different anatomical contexts, further underscoring the need for technical proficiency (30).

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