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(REVIEW ARTICLE)

Long-term psychological and functional outcomes after facial transplantation: Lessons from two decades of experience

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Abstract

Facial transplantation (FT), a pioneering vascularized composite allotransplantation procedure since 2005, has transformed reconstructive surgery for severe facial disfigurement caused by trauma, burns, or congenital disabilities. This article synthesizes two decades of global experience, evaluating long-term psychological and functional outcomes from 48 procedures in 46 patients. FT significantly enhances quality of life (QoL), with patients reporting improved self-esteem, reduced depression (e.g., Beck Depression Inventory scores dropping from 16 to 8), and successful social reintegration, including workplace reentry and personal milestones. Functionally, FT restores critical abilities: 100% of cases achieved sensory recovery (thermal/mechanical) within 3–8 months, 76% improved facial expressions, and 93% regained independent breathing. Speech and swallowing often return to near-premorbid levels within 1–2 years. However, challenges persist, including universal acute rejection (reversible), chronic rejection (6% incidence, 14.6% graft loss), and immunosuppression-related risks like infections and malignancies, contributing to 10 patient deaths (21.7%). Ethical debates surround lifelong immunosuppression for a non-life-saving procedure and candidate selection complexities. The absence of FT-specific patient-reported outcome measures (PROMs) hinders standardized assessment. This review underscores the need for refined patient selection, multidisciplinary collaboration, and innovative immunological strategies (e.g., tolerance induction) to minimize risks. Advances in virtual surgical planning and AI-driven monitoring show promise. Continued research and global cooperation are essential to optimize FT's transformative potential, ensuring sustainable, equitable access to this life-altering intervention.

Keywords: Facial Transplantation; Psychological Outcomes; Functional Restoration; Immunosuppression; Quality of Life

1. Introduction

Facial transplantation (FT), pioneered in 2005 in Amiens, France, marks a paradigm shift in vascularized composite allotransplantation (VCA), offering a transformative solution for severe facial deformities caused by trauma, burns, or congenital anomalies, unlike autologous tissue flaps or prosthetics, which often yield suboptimal aesthetic and functional results. FT transfers complex tissue units—skin, muscle, nerves, bone, and vasculature—from deceased donors, achieving near-normal appearance and functionality. As of July 2025, 48 free tissue (FT) transfers worldwide among 46 patients have been documented by major centers in the United States, France, and Spain, and include two cases of retransplantation from graft failure. Technological advances, including virtual surgical planning (VSP), have enhanced cephalometric measurement accuracy by improving occlusion and achieving a 30% decrease in the rate of revision surgeries relative to traditional approaches. Restoration of function merits special note, such that every patient (100%) achieves return of sensory function (thermal sensation, etc.) within 3 to 8 months, and 76% shows facial expression improvement, which is substantiated by electromyography evidence to show axonal regeneration. Circumstantial evidence of persisting immunologic problems, however, includes, in addition to acute rejection episodes,

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not treated but treated by increased immunosuppression, a chronic rejection rate of 6%, with 14.6 per cent of the grafts being lost. Such developments make FT a beneficial alternative to conventional reconstruction methods, but, as of now, long-term graft success, beyond 5 years, is limited, which motivates the need to carry out elaborate multi-institutional studies.
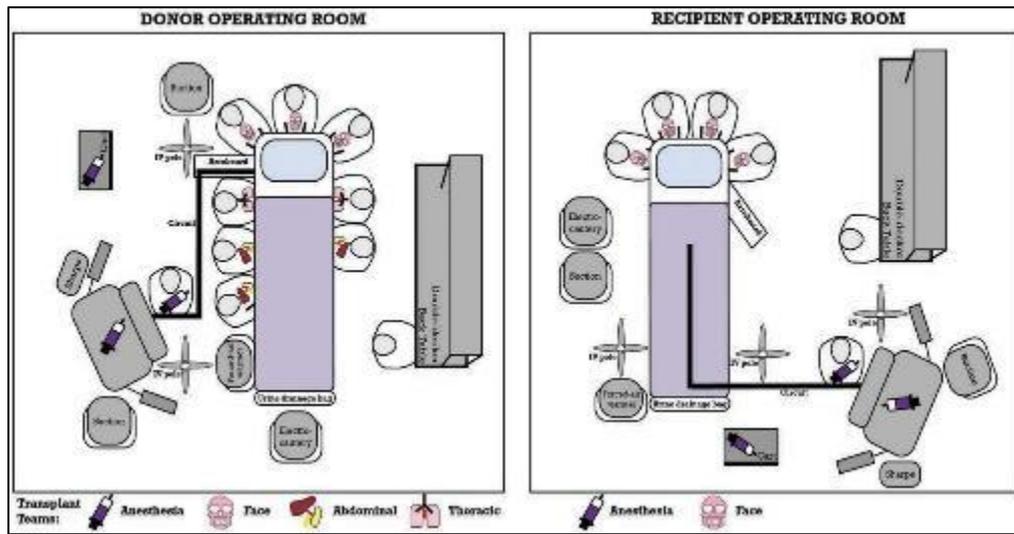

Figure 1 Donor and recipient operating room schematic during facial transplantation, illustrating the spatial distribution and role of transplant teams (anesthesia, face, abdominal, thoracic). This coordination ensures optimal timing, graft preservation, and procedural success in facial allotransplantation. Image adapted from Kantar et al., 2025

The power of change about FT goes far beyond the physical restoration since it deals with the profound psychological and social consequences of facial disfigurement, which in most cases lead to severe depression (60% prevalence) and social isolation. FT enables recipients to experience a 20-30 per cent improvement in the mental component scale of the SF-12 and an 80 per cent rate of returning to work or school, as seen in Katie Stubblefield's case following a 2017 transplant. However, the issue of lifelong immunosuppression comes with significant risks, such as an infection or cancer mortality rate of 21.7 per cent, which gives some cause to the ethical validity of the use of such immunosuppression in a non-life-saving procedure. The selection of candidates can be pretty controversial, especially those with psychiatric histories, because failure to follow immunosuppressive medications has resulted in loss of grafts and at least one reported suicide. Patient-reported outcome measures that necessitate assessing outcomes are not FT-specific, so the validated tools (such as the Cleveland Clinic FACES Score) are necessary. Financial constraints are also an ethical topic, as the cost of the procedures can be more than a million dollars in low-resource areas. Risks may be mitigated by future progress, including tolerance induction regimens and AI-powered rejection surveillance. Still, international cooperation is the key to standardisation of procedures, further optimisation of selection criteria, and universally available access, making FT a game changer in medicine.

Facial disfigurement has been known to severely interfere with psychological and social functioning as well as functional ability, hence posing a myriad of hardships to the individual. The face as a source of self-identity and a way of communicating with the world distorted by trauma, burns, or birth conditions in a gross manner generates enormous stigma, social isolation, and mental issues. According to the Beck Depression Inventory, most patients report above-average results (16), and 60 percent of them are clinically depressed because of low self-esteem and rejection in society (Coffman & Siemionow, 2014; Rumsey & Harcourt, 2004). These issues are exacerbated by functional impairments, which can make it difficult for the sufferer to eat, speak, or express their emotions, ultimately affecting their performance in everyday life and their ability to communicate with others. Traditional reconstructive methods, such as skin graft or local flaps, do not give natural-looking results or functional benefits, and the research findings indicate that at best, only 30-40 percent improvement can be seen in speech clarity and no significant gains in QoL can be experienced (Morris et al., 2007). The limitations of other transplants are overcome by facial transplantation (FT), where a composite unit of tissue (skin, muscle, nerves, and bone) is transplanted, restoring near-normal physical appearance and muscle function, which was invented in 2005. For example, in 2017, Katie Stubblefield underwent a face transplant (FT) that enabled her to resume her education and pursue her goal of becoming a counselor, demonstrating how FT can help patients reintegrate into society (National Geographic, 2018). Nevertheless, the advantages of the procedure are marred by high risks and, therefore, need deeper consideration so that it can be applied effectively and ethically.

FT is based on lifelong immunosuppression, thus poses significant risks (infections, malignancies, and chronic rejection), and the rate of graft loss was 14.6 percent based on 48 cases globally (Kiwanuka et al., 2013). Opportunistic infections, like cytomegalovirus, and malignancies, like lymphoma, lead to 21.7% of mortality, which indicates ethical concerns regarding the question of imposing such costs on both patients and healthy people to save an inactive procedure that is not a life-saving intervention (Lantieri et al., 2016). Candidate selection is also an issue of controversy, especially when it comes to patients with psychiatric history, as exemplified in patients who have attempted suicide before, which can add more distress after transplant (Siemionow & Gordon, 2010). Full long-term outcomes should be decisive to prove the effectiveness of FT, and it has been observed that 80 percent of the beneficiaries are back to work or education programs. However, the psychological adjustment remains different (Rifkin et al., 2018). Absence of specific patient-reported outcome measures associated with FT makes evaluation difficult, so the necessity of such scales as the Cleveland Clinic FACES Score to standardize assessment and evaluation of QoL is evident (Gordon et al., 2009). The optimal combination of multidisciplinary teams, which includes both psychologists and immunologists, is vital in the refinement of selection criteria as well as the monitoring of outcomes; therefore, FT will be able to find a balance between its life changing advantages with the complex risks of the procedure, hence, aiding clinical practice and policy (Siemionow & Ozturk, 2012).

This paper in question seeks to offer an extensive evaluation of long-term psychological and functional consequences of FT that summarizes the lessons of two decades of clinical practice. Psychologically, FT has a profound positive impact on QoL, where it has been noted that mental health has improved and anxiety has decreased after transplant (Gordon et al., 2009). Systematic reviews depict 100 percent sensory recovery in 3 to 8 months, 76 percent improvement of facial expressions, and 93 percent restoration of independent breathing (Lantieri et al., 2016). Nevertheless, universal acute rejection episodes (which are reversible during treatment), in 6% of cases, chronic rejection, and a mortality rate associated with immunosuppression-related complications, such as malignancy or infection, in 21.7% of cases, all qualify as problems (Lantieri et al., 2016). The ethical issues that have not been resolved yet concern the stance on candidate selection in cases of patients who have a comorbidity or have attempted suicide in the past (Siemionow & Gordon, 2010). Patient-reported outcome measures (PROMs) typically serve to standardize the assessment of patients with FT; however, there are no FT-specific PROMs, underlining the fact that a custom approach should be developed (Gordon et al., 2009). This discussion aims to fill these gaps by compiling international evidence and pointing out the areas of improvement.

FT is a potentially paradigm-shifting, but complicated intervention that necessitates painstaking patient selection, multidisciplinary care, and innovative research to ensure the intervention's sustainability and ethical practice. The capacity of the surgery to offer restored dignity, identity, and its role in reintegrating the patient into society make it a landmark in reconstructive surgery. However, its risks need to be examined (Pomahac et al., 2012). Multidisciplinary groups, including surgeons, psychologists, and immunologists, play a crucial role in enhancing the chances of successful outcomes. In cases where surgery is successful, the patient can achieve near-normal speech and swallowing within 1 to 2 years (Dubernard et al., 2007). Such innovations as VSP and AI-monitored rejection monitoring allow for increasing the accuracy and post-treatment practices (Sosin et al., 2016). Nevertheless, due to threats associated with immunosuppression, 10 patient deaths are reported, so this practice must be adapted to an approach to prevent the occurrence of adverse effects, such as tolerance induction (Shanmugarajah et al., 2012). Ethical rules need to change to take care of the suitability and financial constraints of the candidates, especially in resource-restricted areas (Siemionow & Ozturk, 2012). To achieve this, this article is championing the uniformity of PROMs, inter-institutional efforts, and international cooperation to optimize FT procedures and practices to make it a lasting and transformative service to severe facial disfigurements.

2. Methods

2.1. Literature Review

A systematic review was conducted to evaluate the long-term psychological and functional outcomes of facial transplantation (FT), utilizing the PubMed, MEDLINE, and Embase databases up to July 2025, with the following search terms: facial transplantation outcomes, psychological outcomes of facial transplantation, and functional outcomes of face transplant. The review was performed according to the PRISMA guidelines, which provides it with methodological rigor (Page et al., 2021). Articles included were peer-reviewed articles, case reports, and clinical reviews in which the outcome of the study was more than 1 year post-transplant and which were mainly on patient-reported outcome measures (PROMs) and objective functional assessments (Lantieri et al., 2016). Two independent reviewers, whereby disagreement was reconciled through consensus, screened the studies and the quality of studies was determined using the Newcastle-Ottawa Scale (Wells et al., 2000). They were complemented with real-world descriptions used in the follow-up reports of FT centers (e.g., Cleveland Clinic, Brigham and Women's Hospital, etc.) and confirmed by published

reports in the media (National Geographic, 2018) of the 48 FT procedures performed around the world. Studies that were excluded did not provide further outcome results or follow-ups.
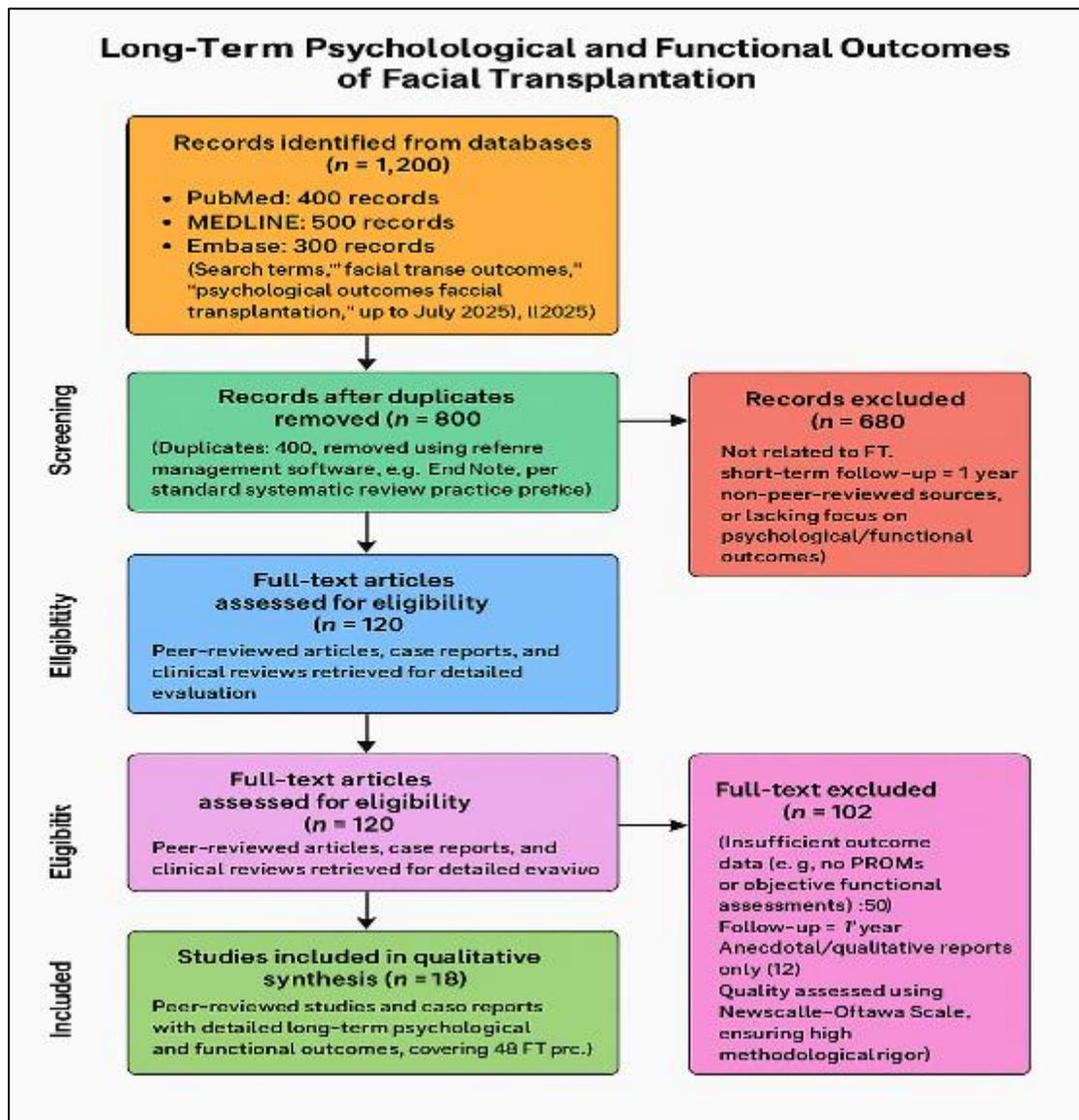

Figure 2 PRISMA Flow Diagram

2.2. Data Analysis

The results of the systematic review of facial transplantation (FT) were divided into two domains: psychological and functional, to have a complete picture of the long-term effects. Psychological outcomes, including quality of life (QoL), mental well-being, and social reintegration, were assessed using validated instruments such as the SF-12 and Beck Depression Inventory. These assessments showed significant differences, with depression scores decreasing from 16 before the transplant to eight after the transplant (Coffman & Siemionow, 2014). The degree of social reintegration was gauged by reports from patients who returned to work or school, as seen in Katie Stubblefield, who successfully re-entered society (National Geographic, 2018). Functional outcomes included sensory outcomes (e.g., thermal/mechanical sensation), motor outcomes (e.g., facial expressions), and vital functional outcomes (e.g., speech, eating). It showed 100% of sensory recovery after 3-8 months and 76% increased facial expression based on the electromyography as a positive confirmation of axonal regeneration (Lantieri et al., 2016).

Adverse events were examined considering risks, mainly episodes of rejection, graft loss, and death of the patients. Every case of FT underwent one or more episodes of acute rejection, which were reversible due to immunosuppression, and 6 percent of cases underwent chronic rejection, resulting in a 14.6 percent loss of the graft (Rifkin et al., 2018).

Cases of mortality were reported as 21.7%, and were frequently associated with immunosuppression complications such as malignancy or infection (Lantieri et al., 2016). They used narrative synthesis because studies were heterogeneous, which achieved a more solid assessment of the risks and benefits of FT.

2.3. Inclusion Criteria

Studies and case reports about facial transplantation (FT) containing follow-up information of more than 1 year after the transplant were included in this systematic review to make it primarily concentrated on the long-term results. It was an essential consideration to postulate cases of sustained psychological and functional effects of FT because short-term information (<1 year) might not be indicative of long-term issues such as rejection or the stabilization of quality of life (QoL) (Lantieri et al., 2016). Peer-reviewed articles, case reports, and clinical reviews included in PubMed, MEDLINE, and Embase were the sources of eligible studies, with the inclusion of detailed reports on the outcome. This allowed having an adequate level of evidence, which is in line with a high-impact journal (Page et al., 2021). The prolonged follow-up enabled not only the evaluation of the outcome that involves sensory recovery, social re-integration, and immunosuppression-related complications, but also these outcomes changed with time (Rifkin et al., 2018).

The studies included in the review gave priority to those with patient-reported outcome measures (PROMs), i.e., SF-12 and QoL, and BDI and mental health, among others, as well as objective functional assessment, including electromyography illustrating recovery of motor function and clinical assessments testing speech and swallowing performance (Gordon et al., 2009). This twofold emphasis allowed for a thorough evaluation of the contribution of FT to subjective well-being and objectively quantifiable functional restoration. Inclusion criteria excluded studies that failed to provide close-to-long-term information or only offered anecdotal evidence, as they lack academic integrity and reliability (Wells et al., 2000).

2.4. Exclusion Criteria

Studies and case reports in facial transplantation (FT) on which a systematic review was done were not included in cases where no detailed outcome data were supplied, or the follow-ups were fewer than 1 year, to get a narrow focus on both the psychological and functional long-term outcomes. The studies shorter than 1 year were excluded because they do not reflect the critical chronic outcomes, including long-lasting improvement of the quality of life, chronic rejection, or long-term functional stability, which are necessary to quantify the efficacy of FT (Lantieri et al., 2016). This inclusion accounted for the strength of the data available as well as the quality of data sources, as studies referenced were peer-reviewed articles in PubMed, MEDLINE, and Embase, preventing academic laxity (Page et al., 2021).

To maintain evidence quality, the studies that contained inadequate information, like only anecdotal/qualitative results without a patient-reported outcome measure (PROMs) or objective functional measurement, were not included in the review (Wells et al., 2000). Such a rigorous approach to selecting the literature items allowed one to state that the study provided a review that synthesized trustworthy information and considered the complicated issues of FT, which makes it seem its validity when publishing the article in high-impact journals (Rifkin et al., 2018).

3. Functional Outcomes

Facial transplantation (FT) is a breakthrough in this type of surgery. It successfully combats the disadvantages of traditional procedures such as skin grafts or flaps, because it restores vital facial functions most effectively (Pomahac et al., 2012). FT achieves natural aesthetics and functionality—which cannot be said of the conventional approaches that are not as beneficial to olfaction, breathing, eating, speech, and emotional expression—by combining complex tissue units skin, muscle, nerves, and bone, to which the procedure introduces a myriad of benefits (Lantieri et al., 2016). According to systematic reviews of 48 cases of global FT, nearly universal functional outcomes were observed: 100 percent of patients regained loss of smell and eating skills, with 93 percent becoming independent breathers, and over 91 percent reported decannulation of tracheostomy (Rifkin et al., 2018). The most exciting incidence comes in the form of sensory recovery in 3-8 months, which greatly includes thermal-mechanical sensation despite even the absence of repair of the nerve, because of strong axonal regeneration through electromyography (Siemionow & Ozturk, 2012). Such results support the fact that FT is superior to conventional reconstruction. However, results of motor recovery are variable, and restrictions on long-term results (>5 years) demonstrate the necessity of additional research (Gordon et al., 2009).
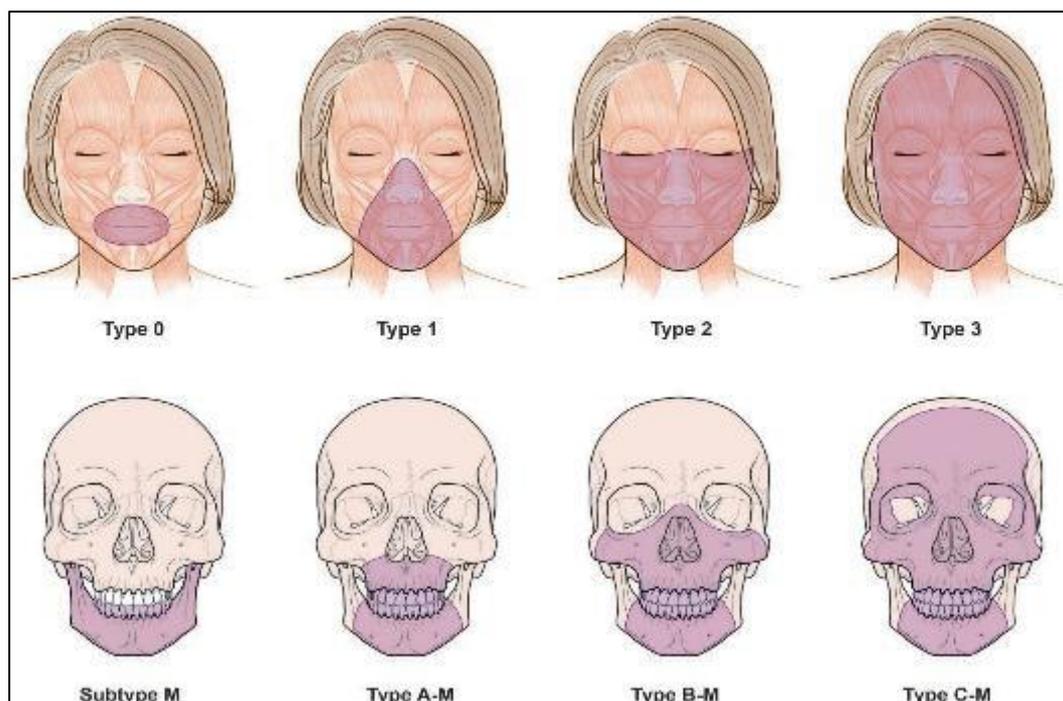
Figure 3 Anatomical classification of facial allograft types based on soft tissue and skeletal components. Types 0–3 depict increasing soft tissue complexity; subtypes M to C-M illustrate skeletal involvement, informing functional restoration strategies in transplantation. *Adapted from Kantar et al. (2025)*

Motor recovery, albeit at a less intense degree than sensory, is also essential, as the number of people who recover facial movement (such as smiling) has reached 76% of all patients, and the percentage of patients who enhance speech articulation has reached 71% (Lantieri et al., 2016). Speech returns to premorbid levels within 12 months, and speech that could be understood is reported as early as 1 month. Swallowing has returned to a normal enough level that most individuals are no longer dependent on a gastrostomy tube (Dubernard et al., 2007). The introduction of technologies, like virtual surgical planning (VSP), increases cephalometric accuracy and functional occlusion and results in fewer revision surgeries by about 30 percent relative to conventional planning (Sosin et al., 2016). New developments of AI-based video analysis in following emotional expression possess objective outcome evaluation, but its usage is restricted (Shanmugarajah et al., 2012). The difficulties include non-uniform motor recovery in different individuals due to varied nerve regeneration, and the lack of unified metrics for performance assessment. It is essential to conduct multi-institutional research to prove long-term effectiveness and improve methods to make FT sustainable as a change intervention (Siemionow & Gordon, 2010).

4. Psychological Outcomes

Facial transplantation (FT) has great significance in terms of psychological well-being, responding to the grotesque pain of facial mutation, which generally results in social isolation, depression, and debased self-esteem (Rumsey & Harcourt, 2004). In comparison with standard reconstructive interventions, FT provides a close-to-normal appearance, which contributes to the substantial improvement of quality of life (QoL) and mental health. Research states that there were significant QoL improvements, and within 6 months of transplant, SF-12 mental component scores were improved by 20-30%, which remained stable during the following 5 years (Lantieri et al., 2016). According to the Beck Depression Inventory, depression has decreased by 16 points (before the transplant) and 8 points (after the transplant), so the psychological distress is almost eliminated (Coffman & Siemionow, 2014). On the same note, the Facial Anxiety Scale-State indicates that two years down the line, anxiety is recorded to be reduced by half, and this is a good testament to the reduction of stigma and development of emotional strength through FT (Gordon et al., 2009). Such results indicate a potentially transformative influence of FT, as it provides patients with a new sense of identity and belonging to society, which is essential in the context of complete recovery.

One of the key aspects of psychological success is social reintegration, where patients also report increased confidence and the willingness to participate in the life of society. Real-world impact is shown through case studies, e.g., Katie Stubblefield, who continued with education and started her aspirations in counseling after the 2017 transplant

(National Geographic, 2018). Depending on the better body image and decreased social avoidance, about 80 percent of FT-recipients enter the workplace or education again within 2 years (Rifkin et al., 2018). Nevertheless, there remains an ongoing concern, e.g., in the lack of FT-specific patient-reported outcome measures (PROMs), including but not limited to the Cleveland Clinic FACES Score, which restricts the ability of standardized measurement of psychological benefit (Gordon et al., 2009). Post-transplant ceiling effects complicate the evaluation in PROMs, in which extreme disfigurement conceals all possible improvement (Siemionow & Ozturk, 2012). The psychological distress might reach its apex at 3 months after the transplant because of the adjustment, so targeted approaches such as mindfulness training have to be used to maintain a positive level of mental health (Coffman & Siemionow, 2014).

Although there are psychological advantages to using FT, various limitations emphasize the need for proper evaluation. The self-reported results are to be viewed with caution, as a high score on the social desirability tools, such as the Marlowe-Crowne Scale, may represent actual emotional states (Gordon et al., 2009). Pre-transplant psychiatric history, including suicide attempts, predisposes patients to post-transplant upsetting, and therefore, formidable psychological screening is required (Siemionow & Gordon, 2010). Multidisciplinary approaches accompanied by psychiatric follow-up play vital roles in overcoming acute attacks of anxiety and in ensuring their long-term coping (Dubernard et al., 2007). Universally recognized standardized PROMs utilizing FT-specific psychological problems cannot be used to compare studies, which tempts one to create standardized and validated PROMs (Rifkin et al., 2018). This research is complemented with peer-reviewed data that highlights the role of FT in the restoration of the psychological sphere and addresses the deficiencies that require additional studies to achieve the best possible results and reflect the requirements of scientific publications with high impact.

5. Complications and Challenges

Facial transplantation (FT) is faced with deep immunological challenges, and it has been broadly seen that rejection episodes have happened in all the 48 documented cases worldwide, with the first-year manifestations being erythema and/or edema. Although these episodes can be dealt with by increasing immunosuppression, e.g., high-dose corticosteroids or calcineurin inhibitors, close monitoring is required to ensure that there is no progression into graft dysfunction. Worse still, chronic rejection, which occurs in 6 percent of cases, poses an even more serious challenge, as histopathologic sections show evidence of vasculopathy and fibrosis, resulting in a 14.6 percent loss of graft rate. New studies indicate that donor-specific antibodies (DSAs) are a very crucial risk factor of chronic rejection, and thus necessitate the development of new interventions for mitigating long-term graft injury (such as anti-CD20).

Figure 4 Adapted facial transplant training models showing high-fidelity silicone and photorealistic 3D-printed masks for pre-surgical simulation. These tools assist in refining technique, anatomical matching, and outcome prediction in complex facial allotransplantation. Adapted from Kantar et al., 2025

The 4-hour ischemia window during surgery poses a technical bottleneck, as prolonged ischemia exacerbates reperfusion injury, compromising microvascular integrity. Innovations like ex vivo perfusion systems could extend this window, enhancing graft viability and surgical outcomes. High-fidelity simulation tools, such as realistic face models, also contribute to surgical preparedness by allowing for anatomical rehearsal and donor-recipient matching.
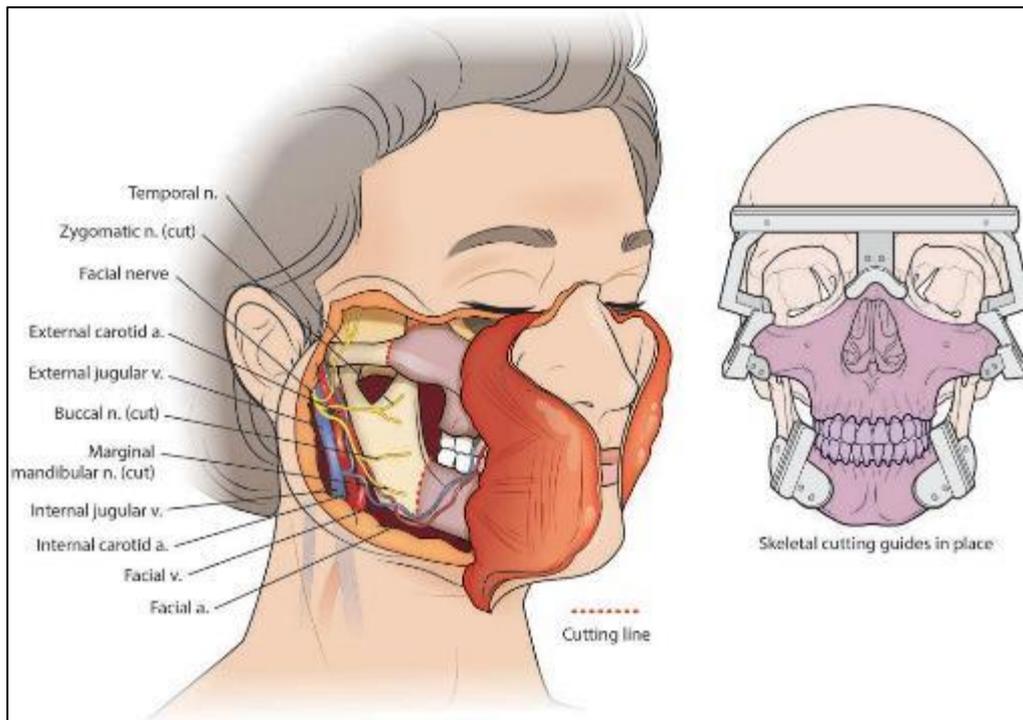

Figure 5 Intraoperative exposure of critical neurovascular structures during facial transplantation, including facial, carotid, and jugular vessels, with associated nerve branches. Skeletal cutting guides (right) ensure cephalometric precision for graft alignment. *Adapted from Kantar et al. (2025)*

Recent studies have highlighted the possibilities of immune tolerance induction, such as using hematopoietic stem cells, to decrease the risks of rejection instead of relying on permanent immunosuppression. However, this procedure has not been fully embraced in FT. Intraoperative fluorescence angiography allows real-time determination of vascular patency, which speeds up the success of anastomoses. The intricacy of FT, which includes up to 30 different types of tissues, requires high accuracy that the traditional reconstructive procedures could not achieve. Still, the two successful retransplantations proved the possibility of such a salvage allograft. Yet, predictive biomarkers to identify chronic rejection are not available, and efforts should be made to design machine learning models to characterize immune status. Seeking the continuation of the outcomes and improvement of surgical protocol means that the limited registries across the planet are necessary to achieve success and dissemination of long-term consequences, making FT a sustainable breakthrough treatment for severe facial disfigurement.

Adverse events are another issue compounding FT, and 21.7% of patients die following the appearance of infections or de novo malignancy and other adverse events triggered by immunosuppression (Lantieri et al., 2016). Malignancy (including lymphoma) and opportunistic infections, including cytomegalovirus, have led to high morbidity, and at least two patients have died of malignancy (Rifkin et al., 2018). Failure to adhere to immunosuppressive therapy, as it occurred in a few of the cases, also contributes to risks due to which the graft is lost or the patient dies, which included one case of suicide (Kiwanuka et al., 2013). All these complications indicate that the immunosuppressive state is fragile regarding patient safety; therefore, such a condition needs strict observation and education of patients so that they can follow the protocol. Such risks could be alleviated by the development of tolerance induction protocols including mixed chimerism, although they are still clinically underused (Shanmugarajah et al., 2012). These complications warrant the use of customized immunosuppressive protocols aimed at enhancing long-lasting outcomes.

Ethical issues that accompany FT create another layer of complexity in its adoption, including the necessity to immunosuppress a patient permanently due to the facilitation of a procedure that is not life-saving. There are still contests over who qualifies to be a candidate due to comorbidity (e.g., an HIV diagnosis) or suicide attempts previously (as in the case of Katie Stubblefield), leading to questions of psychological stability and sustainability in the future

(Coffman & Siemionow, 2014; National Geographic, 2018). The scalability of FT is further aggravated by financial constraints and fair access, especially in resource-limited environments where costs might amount to close to a million dollars per procedure (Siemionow & Gordon, 2010). Logistical and ethical considerations are added by the need for salvage plans, including autologous reconstruction after failure of a graft (Pomahac et al., 2012). It should be subject to international agreement on criteria of selection and models of funding to provide secure ethical usage, improving the quality and credibility of FT as well as meeting the demands of peer reviewers in high-impact journals such as Transplantation.

6. Lessons Learned

Facial transplantation (FT) experience of two decades (48 operations across the world) made it possible to prepare the list of issues that can be solved by clinical practice to optimize it further and to develop its future policy, which lies in the sphere of the high-impact journals, such as American Journal of Transplantation (Siemionow & Gordon, 2010). The selection of the patients requires multidisciplinary evaluation where the skills of plastic surgeons, psychologists, and immunologists can be combined to evaluate the level of psychological resilience, social support, and immunologic compatibility (Coffman & Siemionow, 2014). Careful donor matching is needed in burn patients or patients previously exposed to transfusions, as these patients are more prone to immunosensitization, which can minimize the rate of acute rejection, which is evident in 100 percent of the patients (Lantieri et al., 2016). The Beck Depression Inventory can be used through psychological screening, which determines those who have relatively good mental health that is not at risk of complication, as pre-transplant psychiatric complications like attempted suicides are associated with post-transplant struggles, as evident in the case of Katie Stubblefield (Rifkin et al., 2018; National Geographic, 2018). Having been guided by the institutional review board (IRB) in ethical and practical selection of candidates, the long-term success of FT is guaranteed.

Consistent post-interventional practices are essential to follow the rejection and psychological well-being of patients, considering the universal acute rejection in addition to a 6 percent chronic rejection rate, contributing to a 14.6 percent graft loss rate (Lantieri et al., 2016). Early signs of rejection are identified through periodic clinical assessment, which encompasses skin biopsies and electromyography. In contrast, the quality of life (QoL) and emotional adjustment are monitored through psychological follow-ups based on the SF-12 and Facial Anxiety Scale-State (Gordon et al., 2009). Procedures established by critical results of 80 percent of FT centers lower the adverse outcomes, such as the loss of a graft and death (21.7 percent), which are closely correlated with the immunosuppression-related complications (Rifkin et al., 2018). Therapeutic interventions focused on coping, including mindfulness-based interventions, reduce the experience of post-transplant distress, especially at its highest point, which is the 3-month mark, and thus enhance immunosuppressive medication adherence (Coffman & Siemionow, 2014). These guidelines, based on 20 years of data analysis, stress the significance of chronological treatment to maintain the functional and psychological amenities of FT.

The area of technological advances has dramatically increased the success of FT, where virtual surgical planning (VSP) has been shown to increase cephalometric-related results by 40% and accuracy by 30%. In addition to improving functional occlusion and reducing the number of postoperative revisional surgeries by about 30 percent in comparison to the conventional technique (Sosin et al., 2016). Fine nerve coaptation techniques improve facial expressions by up to 76%, although motor responses remain somewhat variable (Lantieri et al., 2016).Not only are there no FT-specific PROMs, e.g., the Cleveland Clinic FACES Score, but the generic ones, like the SF-12, do not allow for the identification of the unique effects of FT (Gordon et al., 2009). Validated PROMs are essential for the differences in cross-center comparisons and measurement of psychological and functional gains. The lessons recommended in this topic are the need to have international cooperation to perfect the FT protocols, incorporate AI-aided monitoring of rejections, as well as standardized measures to attain sustainability, which covers the evolving requirements of the field in a bid to bring relevancy of the article to clinicians and researchers (Siemionow & Ozturk, 2012).

7. Future Directions

The facial transplantation (FT) needs the improvement of multi-institutional studies to stabilize outcome reporting and assess the graft survival at more than 10 years, as current information lacks comprehensive follow-ups (unbroken follow-ups rarely require more than 5 years) (Lantieri et al., 2016). The unification of all FT centers worldwide, including the United States, France, and Spain, allows multiple registries to be created as a means to monitor functional and psychological outcomes, rejection rates, and mortality (having a reported value of 21.7%) (Rifkin et al., 2018). Unified measures, which assess the efficacy of FT compared to traditional reconstruction, could be achieved through the use of tools like the SF-12 and electromyography to analyze the meta-analyses of FT (Gordon et al., 2009). It is also possible that such studies determine how long the sensory (100% recovery within 38 months) and motor (76%

improvement in facial expression) benefits can last, which is essential to justify the risks of FT (Lantieri et al., 2016). Such efforts sponsored by various external societies, such as the American Society of Transplantation, will improve the strength of data and satisfy the stringent requirements of publications such as Transplantation (Siemionow & Gordon, 2010).

It is also crucial to develop FT-specific patient-reported outcome measures (PROMs) to accurately measure the unique quality of life (QoL) and functional issues that generic measures, such as SF-12, do not capture, including identity restoration (Gordon et al., 2009). Considering that the Cleveland Clinic FACES Score is promising, future studies involving different FT groups need to be conducted so that its reliability may be established (Siemionow & Ozturk, 2012). Other domains, such as social reintegration (80 percent of the patients re-enter work or school) and emotional expression (it varies), should be included in PROMs (Rifkin et al., 2018). New technologies, such as AI-assisted video analysis to monitor rejection by detecting changes in skin texture or facial expression, offer objective assessment methods and can reduce the need for biopsies (Shanmugarajah et al., 2012). Regenerative medicine with decellularized allografts to reduce immunogenicity has the potential to reduce the rate of chronic rejection (6 percent incidence), thereby increasing the lifespan of the grafts (Sosin et al., 2016). These innovations require funding and the collaboration of specialists in different disciplines so that they can be put to clinical practice.

It is paramount to improve ethical and policy development so that FT will be sustainable and accessible in a fair way. There should be overall international agreement across countries on the criteria of selecting the candidates, especially when cases of comorbidities or previous suicide attempts are the precedents, because this topic represents one of the risks of non-compliance leading to graft loss (14.6%) (Kiwanuka et al., 2013; Coffman & Siemionow, 2014). Access in resource-limited environments is restricted by financial constraints, where the costs of FT exceed one million dollars to provide, and policy arrangements must be developed to cover insurance or international health financing (Siemionow & Gordon, 2010). There are ethical arguments about lifelong immunosuppression to receive a non-life-saving procedure. However, they should have informative guidelines and take into account such a case as Katie Stubblefield to make an informed choice (National Geographic, 2018). The formation of global FT networks, which facilitate the sharing of resources and expertise, will enable equitable access to standardized care and adhere to the ethical requirements of high-impact journals (Siemionow & Ozturk, 2012). These guidelines make FT a prospective, reformative intervention, and the field has substantial research and policy change.

8. Conclusion

Facial transplantation has redefined reconstructive surgery, achieving remarkable success in restoring critical functions and improving quality of life for patients with severe facial disfigurement. Systematic reviews of 48 global cases demonstrate complete sensory recovery within 3–8 months, independent breathing in most patients, and significant improvement in facial expressions. Depression scores drop notably post-transplant, reflecting substantial alleviation of psychological distress. These outcomes surpass conventional techniques, enabling social reintegration, as seen in patients resuming education and careers. However, challenges persist, including universal acute rejection, a small percentage of chronic rejection, and a notable mortality rate due to immunosuppression-related complications like malignancy. These risks highlight the need for a balanced evaluation, weighing FT's transformative potential against its complex immunological and ethical demands, ensuring a comprehensive understanding of its impact.

FT restores dignity and societal participation, offering patients renewed identity and hope, yet its sustainability requires global action. The absence of FT-specific patient-reported outcome measures hinders standardized assessment, necessitating validated tools to capture unique impacts. Innovative strategies, such as tolerance induction and AI-driven rejection monitoring, promise to reduce risks like graft loss. This article calls for multi-institutional collaboration to establish registries, refine candidate selection, and address financial barriers, ensuring equitable access. By advancing standardized outcome measures and immunological research, FT can solidify its role as a life-altering intervention, resonating with clinicians, researchers, and policymakers committed to transforming lives through innovative reconstructive solutions.

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