



FACIAL TRANSPLANTATION - THE FUTURE OF RECONSTRUCTIVE SURGERY - A REVIEW

Maxillofacial Surgery

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ABSTRACT

The development of facial reconstructive surgery has been a gradual , organic, and a promising treatment option for patients with severe facial disfigurement. There have been 25 instances of facial allograft transplants performed globally with promising outcomes since the first case was documented in France in 2005. As choosing possible candidates for face transplantation is arguably the most crucial and difficult task , a long list of the inclusion and exclusion criteria forms the basis of the candidate selection protocol. There are many surgical considerations and challenges that need to be kept in mind for a successful Facial transplant which involve pre-operative , intra-operative and post-operative factors. This review emphasises on the afore mentioned points and sheds light on the outcomes of surgery and the latest advances in the field of Facial Transplantation. As a fascinating and an emerging area of reconstructive surgery , Face Transplant gives patients with severe disfigurements a chance to reclaim their humanity and dignity on a social and physical level, thus facial becoming a valuable tool in the armoury of Maxillofacial and Reconstructive surgeons.

KEYWORDS

Facial, Transplantation, Allotransplantation, Graft

INTRODUCTION

The development of facial reconstructive surgery has been a gradual , organic, and a promising treatment option for patients with severe facial disfigurement.¹ Only recently after the development of novel medications and the invention of surgeons made facial transplantation (FT) feasible. One novel surgical method that might be regarded as a new paradigm in facial reconstruction is facial allotransplantation (FAT) . One of the most common applications of facial transplantation is composite tissue allotransplantation (CTA) or vascular composite allograft (VCA). There have been 25 instances of facial allograft transplants performed globally with promising outcomes since the first case was documented in France in 2005.²

HISTORY

At least 18 FATs have been conducted since the first Partial FAT was carried out in 2005 by Bernard Devauchelle, an **Oral and Maxillofacial Surgeon**, Benoit Lengele, a Belgian Plastic Surgeon and Jean-Michel Dubernard in Amiens, France. The world's first full face transplant was completed in 2010 in Spain.³

INDICATIONS FOR FACIAL TRANSPLANT SURGERY²

- Extensive skin damage,
- Tissue loss and disfigurement,
- Bullet injuries,
- Severe burns,
- Traumatic injury,
- Congenital defects,
- Malignant disease,
- Infectious diseases

FAT may offer an alternative to maxillofacial prosthesis and surgical grafts and flaps in the treatment of severe facial disfigurement, and it may even be a better therapy despite the numerous obstacles that need to be addressed.

Patient Selection Process

During the entire process of preparation for the transplant surgery, choosing possible candidates for face transplantation is arguably the most crucial and difficult task .⁴ A long list of the inclusion and exclusion criteria forms the basis of the candidate selection protocol. The patient's vision is an important criterion for selection where many patients with facial trauma have lost their vision or present with limited vision. This poses a challenge in the functional outcomes of these patients and hence they must be closely monitored.⁵

Surgical Plan

Planning and carrying out facial transplants that incorporate both soft tissue and bone components should emphasize on both craniofacial and orthognathic factors. By aligning the face correctly with the base of the skull, measurements in the form of cephalometric parameters are taken in order to restore the normal anatomy and restoration of speech, airway function, and occlusion.⁵ The surgical component of the transplant, which involves creating recipient stereolithographic models, intraoperative cutting guides, and digital preoperative and postoperative models, can be planned using computerized surgical planning. The **facial artery functions as the primary pedicle** and is the principal arterial supply to the facial skin envelope. Although common, facial arterial dominance in the facial blood supply is erratic. Therefore a meticulous vascular workup before facial transplantation are crucial.²

Lengele proposed a classification for FCTAs (Facial Composite Tissue Allotransplantation)⁶ based on the amount and type of tissue transplanted i.e.

SURGICAL CONSIDERATIONS AND CHALLENGES

Medical

Patients must adhere to a strict immunosuppressive regimen, and it can be challenging to strike a balance between the side effects , opportunistic infections and the risk of graft rejection.⁷ The side effects are typical of all transplantations , a rejection may result in transplant loss and may be more disastrous than the initial disfigurement since the graft may need removal.¹

Psychosocial

For patients to meet the demands of the therapy regimen and rigorous rehabilitation, psychological resilience is a crucial requirement. Therefore, it's important to recognize and treat any social issues in the best way possible. The patient's situation socially , family support and religious beliefs are important factors in their re-integration into society. Highly skilled care in the community and continuous social work support are required.¹

Ethical

Identity transfer is a major ethical conundrum in the field of facial transplantation. Proponents of the procedure refute concerns about identity transfer, arguing that after a facial transplant, neither the recipient's nor the donor's identities remain intact. Instead, a "third" face is created, which the recipient will eventually recognize as his or

her own, once functional recovery has been attained.¹

TABLE 1. Classification of Facial Transplantation Allografts

Type	Description	Subclassification	Comment
I	Lower Central (nose, lips and chin)	IA: Soft tissues Only IB: Bone included (Mandible)	
II	Mid Facial Allograft (nose, upper lip, cheeks)	IIA: Soft Tissues Only IIB: Bone included (Maxilla, zygoma, palate)	
III	Upper Facial Allograft (forehead, eyelids, root of the nose)		Only soft tissues, no bone transplanted
IV	Total Facial Skin Allograft		Only skin and subcutaneous fat transplanted as "carnival mask"
V	Full Facial Allograft (Types I + II + III)	VA: Soft tissues Only VB: Bone involved (Mandible, maxilla, palate, zygoma, nose)	

Reproduced after B.G. Lengele, *Clin Plast Surg* 36(2009) 507-521.

IMPORTANCE OF AN INFORMED CONSENT

To ensure autonomy of decision-making, full, independent, and objective disclosure of the known risks and benefits of a therapy and clear patient understanding is necessary.⁸ In the case of FATs, psychological aspects must be prioritized because identity issues and the strict post-operative management one faces can be a significant source of mental stress. The patient's ability to make decisions should be respected in the same manner as that of any other ameliorative procedure.¹

PRE-OPERATIVE CONSIDERATIONS

In FT, considerations include matching the skin tone, hair color, and facial structure. Histocompatibility is typically more challenging to achieve, as most FT candidates are typically immunosensitized due to initial resuscitation with blood products and skin grafting. Although crossmatching is traditionally performed with peripheral blood using flow cytometry, a disproportionate rate of false negatives may be observed in highly sensitized patients. As a result, many centers have now adopted the use of donor lymph nodes for matchmaking. Comprehensive and long-term psychiatric evaluation is a crucial part of the work-up and continued care of FT candidates.⁹

POST-OPERATIVE CONSIDERATIONS

Allograft survival is ultimately determined by allograft surveillance, lifetime immunosuppression, and rejection management. Anti-thymocyte globulin (ATG) or anti-Interleukin-2 receptor antibodies combined with tacrolimus, mycophenolate mofetil (MMF), and steroids are the standard components of immunosuppression induction regimens. Steroid combinations with ATG, ATG with anti-CD20, ATG with MMF, or ATG with anti-CD52 are some other documented induction regimens.⁹ Although some groups have used dual therapy with MMF and tacrolimus, maintenance therapy typically consists of triple therapy with corticosteroids, MMF, and tacrolimus as immunosuppression increases susceptibility to opportunistic infections, appropriate antimicrobial prophylaxis is required, especially in light of the distinct craniomaxillofacial flora.¹⁰

OUTCOMES

a. Functional

Functional results from face transplantation are quite impressive. The most consistent outcome is the sensory nerve recovery of the facial allografts. When considering the results of skeletal recovery, motor recovery is slower (between 6 and 18 months) with average functional outcomes visible by the end of the first week following transplantation when the patients are able to consume food and liquids. Many a times, an obturator support is required to help the speech become more comprehensible. Breathing and smell also improve with the restoration of nasal airways.⁵

b. Esthetic

Comparing the cosmetic results of face transplantation to the pre-transplant facial deformities, an improvement is naturally seen. However, a stigma associated with the past deformity still affects a large number of face transplant patients. This stigma includes irregularities in shape and colour matching, as well as the absence of a natural looking face. These are the less significant issues in light of the advantages of functional restoration, nevertheless, as face transplant candidates are chosen more carefully and surgical techniques are improved, the procedure's aesthetic component will become just as crucial as its functional component.⁵

ADVANCES IN FACIAL TRANSPLANTATION

Cross-sex facial transplantation (CSFT) has been suggested as a way to increase the limited VCA donor pool in line with the field's growth. Clinical transplantation of the extremities has shown promising results, with 4 transplants of the upper extremities and 1 of the lower

extremity.¹¹ Despite not having been used in a clinical context, CSFT has demonstrated encouraging outcomes in cadaveric simulations, and survey results indicate that both the ethics community and the general public support the technique.

There has only been one clinical FT involving a unilateral condyle so far.¹² Even with a normal TMJ anatomy on the pre-transplant imaging, FT candidates may experience complications related to the TMJ, as attempts at reconstruction following trauma to the craniofacial skeleton can result in TMJ ankylosis. In theory, including bilateral condyles in the allograft could be a viable option for FT candidates with TMJ pathology, either pre-existing or as a result of their injury, to restore TMJ function.⁹

FACIAL TRANSPLANTATION IN THE POST-COVID-19 WORLD

The global economic crisis that has accompanied the COVID-19 pandemic has put an unparalleled burden on healthcare systems across the globe. The financing models for FT vary greatly amongst nations and medical systems. FTs have typically been funded by public research initiatives or the national health care system in European nations. The year 2018 saw the performance of the first FT that was partially funded by a third-party private insurer mediated by the employer.¹³ Some patients have sought VCA treatment abroad due to financial, regulatory, and access-related reasons. Some teams have already started providing FT recipients who live far from their VCA centres with long-distance follow-up care. In the post-COVID-19 era, this strategy might become more popular as the pandemic's challenges collide with telemedicine's rapid integration into the field of Maxillofacial and Reconstructive surgery.⁹

CONCLUSION

A viable treatment option for individuals with severe facial disfigurements, Facial Transplantation is the future. Technological feasibility of FAT has been achieved across a range of indications due to advancements in CTA transplantation and immunosuppressive therapy.

Given the current state of affairs, it may eventually make its way into the reconstructive ladder as a common procedure provided the candidates meet the eligibility criteria. There are compelling arguments for the procedure's ethical justification, but limits must be placed so that these patients can only be managed by multidisciplinary teams with the necessary training and experience to provide high-quality care. Future studies should concentrate on the long-term psychological and medical consequences for patients who have received transplants. As a fascinating and an emerging area of reconstructive surgery, FT gives patients with severe disfigurements a chance to reclaim their humanity and dignity on a social and physical level thus facial becoming a valuable tool in armoury of Maxillofacial and Reconstructive surgeons.

REFERENCES:

1. Woods J. Facial transplantation: where it is now and its future in reconstructive surgery.
2. Eun SC. Facial transplantation surgery introduction. *Journal of Korean medical science*. 2015 Jun 1;30(6):669-72.
3. Rifkin, William J.; David, Joshua A.; Plana, Natalie M.; Kantar, Rami S.; Diaz-Siso, J. Rodrigo; Gelb, Bruce E.; Ceradini, Daniel J.; Rodriguez, Eduardo D. (August 2018). "Achievements and Challenges in Facial Transplantation". *Annals of Surgery*. 268 (2): 260–270.
4. Wo L, Bueno E, Pomahac B. Facial transplantation: worth the risks? A look at evolution of indications over the last decade. *Curr Opin Organ Transplant*. 2015;20:615–20.
5. Siemionow M. The miracle of face transplantation after 10 years. *British Medical Bulletin*. 2016 Dec 1;120
6. Barret JP, Gavalda J, Bueno J, Nuvials X, Pont T, Masnou N, Colomina MJ, Serracanta J, Arno A, Huguet P, Collado JM. Full face transplant: the first case report. *Annals of surgery*. 2011 Aug 1;254(2):252-6.
7. Whitaker IS, Duggan EM, Alloway RR, Brown C, McGuire S, Woodle ES et al. Composite tissue allotransplantation: a review of relevant immunological issues for plastic surgeons. *J Plast Reconstr Aesthet Surg*. 2008;61(5):481-92
8. Renshaw A, Clarke A, Diver AJ, Ashcroft RE, Butler PEM. Informed consent for facial transplantation. *Transpl Int*. 2006;19:861-7
9. Diep GK, Berman ZP, Alfonso AR, Ramly EP, Boczar D, Trilles J, Colon RR, Chaya BF, Rodriguez ED. The 2020 facial transplantation update: a 15-year compendium. *Plastic and Reconstructive Surgery Global Open*. 2021 May;9(5).
10. Broyles JM, Alrakam M, Ensor CR, et al. Characterization, prophylaxis, and treatment of infectious complications in craniomaxillofacial and upper extremity allotransplantation: A multicenter perspective. *Plast Reconstr Surg*. 2014;133:543e-551e
11. Jablecki J. World experience after more than a decade of clinical hand transplantation: Update on the Polish program. *Hand Clin*. 2011;27:433–42, viii.
12. Cavadas PC, Ibáñez J, Thione A. Surgical aspects of a lower face, mandible, and tongue allotransplantation. *J Reconstr Microsurg*. 2012;28:43–47.
13. Kantar RS, Ceradini DJ, Gelb BE, et al. Facial transplantation for an irreparable central and lower face injury: A modernized approach to a classic challenge. *Plast Reconstr Surg*. 2019;144:264e–283e.