

# Face transplant: A revolutionary approach and role of dentist

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## Abstract

Face transplant forms a part of vascularized composite tissue allotransplantation (transfer of organs or tissue from one individual to another), which is the basis of modern microsurgery and reconstructive plastic surgery. A face transplant is a medical procedure to replace all or part of a person's face using tissue from a cadaver. Face transplantation can include skin from the face, neck and/or scalp, lips and tongue, muscles used for facial movement and expression, and nerves to animate as well as to provide sensation. Supportive bony structures can also be included. Oral surgeons play a major role in alignment of teeth, reconstruction of midface, maxilla, mandible including teeth, and tongue. It gives better esthetics and functional results including increase in the opening of mouth, chewing, and breathing. The new computer-assisted planning and execution system aims to make it less likely to misalign the new set of bones, jaws, and prevent other reconstructive abnormalities. In spite of risks and rejection, face transplant gives a better appearance, i.e., gives a new life to the patient and improves his social status and lifestyle.

## Introduction

One's face is often considered their identity which represents the ancestry, ethnicity, and self-perception.<sup>[1]</sup> In today's esthetic driven society where smile and facial attractiveness represents one's happiness, mental state, and success, it is very difficult to attain normal and socially acceptable facial architecture after gross disfigurement.<sup>[2]</sup> Face transplant is a revolutionary procedure by which we can achieve so successfully.

The movie Face-Off starring John Travolta and Nicolas Cage is a classic example of how spectacular face transplant could be.

## History

The world's first partial face transplant was done in November 2005 by a group of French surgeons lead by prof. Jean Michel Dubernard on a 38-year-old Isabella Dinoire after being bitten by a dog.<sup>[3,4]</sup>

First, full-face transplant was done in 2010 by a team led by Dr. Barret on Óscar who lost his facial structure by accident and injury.<sup>[5]</sup>

## Face Transplant: A Revolutionary Approach and Role of Dentist

### Principle

Face transplant forms a part of vascularized composite tissue allotransplantation (transfer of organs or tissue from one individual to another), which is the basis of modern microsurgery and reconstructive plastic surgery.<sup>[6]</sup> The first clinical use of this principle was done in 1998 with the first successful human hand transplant.<sup>[7]</sup> After 7 years of this, the first human face transplant was performed in Amiens, France.<sup>[3]</sup>

### Types

#### *Partial facial transplantation*

It consists of nose, lips, and amounts of chin and cheek. It requires sensory and motor nerve anastomoses as it includes skin, mucosa, and muscle. The dynamic and static facial slings are used to restore the functional movements if motor anastomoses failed.<sup>[8]</sup>

### Full-face transplant

It consists of whole face transfer from donor to recipient. If it fails, then the following treatment modalities are used:

- Autologous skin graft application.
- Artificial skin such as dermal substitute and Integra application followed by skin graft.
- Repeat the face transplant procedure, but it has unfavorable prognosis because of prior sensitization.

In the future, full-face transplant will also include nose, ears, and eyelids transplant according to patient's needs.<sup>[8]</sup>

Table 1 shows classification of facial transplantation allografts.<sup>[9,10]</sup>

### Indication

Patients having disfigured face by means of:

- Accidents/traumatic injury, burn.
- Birth defects/congenital defects.
- Malignant disease.
- Facial structures lost due to infection which are untreatable with conventional surgical technique.

Table 2 shows determining patient eligibility.<sup>[11]</sup>

Table 3 shows finding a match (DONOR).<sup>[11]</sup>

### Appearance after full-face transplant

Prediction of appearance after full-face transplant is challenging. Various studies which used computer modeling suggest that recipient face resembles a "third face" which neither looks like recipient pre-injury nor the donor, but it takes the characteristics skeleton structure of recipient and soft tissues of donor. The new subcutaneous tissues and skin move better than the pre-transplant grafted face.<sup>[8]</sup>

### Informed consent<sup>[12]</sup>

The patient should understand the following contents before undergoing face transplantation.

### Identity

Patient will most likely generate a third face which will not look like recipient pre-injury. This may develop identity issues with the patient.

**Table 1:** Classification of facial transplantation allografts

Type	Description	Subclassification	Comment
1	Lower central (nose, lips, and chin)	IA: Soft tissues only IB: Bone included (mandible)	
2	Midfacial allograft (nose, upper lip, cheeks)	IIA: Soft tissues only IIB: Bone included (maxilla, zigoma, palate)	
3	Upper facial allograft (forehead, eyelids, root of the nose)		Only soft tissues, no bone transplanted
4	Total facial skin allograft		Only skin and subcutaneous fat transplanted as "carnival mask"
5	Full facial allograft (Types I+II+III)	VA: Soft tissues only VB: Bone involved (mandible, maxilla, palate, zigomas, nose)	

### Immunosuppressant drugs

Patients have to take immunosuppressant drugs lifelong. Inability to do so would result in rejection of graft. There will be significant side effects of those drugs such as infective and neoplastic and CVS complications, though monitoring is essential for rest of the life.

### Rejection

Complete graft loss may occur followed by rejection which can be treated with altering medicine or it may require further surgery. Rejection of graft may worsen patient's appearance.

### Psychosocial issues

Psychological acceptance of the third face may take time. Psychological relationship between post operative third face and pre-injurious face is still under study.

### Surgical issues

Face transplant has similar risk and mortality as any other free flap surgery. Technical failure has been reported to about 4%.

### Functional recovery

Functional recovery is variable and unpredictable and may take years.

### Media interest

As it is a modern and revolutionary procedure, media interest is most likely high.

### Surgical Procedure<sup>[13,14]</sup>

- Surgical team:** It is a multidisciplinary approach. Experts from reconstructive surgery such as plastic and oral and maxillofacial surgery, orthodontic, psychiatry, otolaryngology, infectious disease, social work, nursing, nutrition, physiotherapy, ophthalmology, and pain medicine should work together to provide the best possible care for patients.
- Selection of donor and recipient:** Criteria for selection of donor and recipient are discussed earlier. Harvesting the

**Table 2:** Determining patient eligibility

Criteria	Description
Age	At least 18 years of age
Involvement	Minimum of 25% facial structure should be lost
Patient compliance	Patient should agree to take antirejection drugs for lifetime
Pregnancy	Pregnant patient should wait for 6 weeks after delivery.
Limitation of traditional surgery	Where conventional surgery cannot restore the appearance

**Table 3:** Finding a match (DONOR)

Criteria	Description
Age	Donor should 10 years older to 20 years younger than recipient.
Skin texture and color	Should be same
Time	Transport time of donor part must be within 4 h
Consent	The donor's family must provide consent
Blood grouping	Blood group of donor and recipient should be matched and cross match should be negative

facial flap and vessels from a brain-dead donor are the first steps of transplant procedure.

- Tracheostomy is performed simultaneously in both recipient and donor patients.<sup>[15]</sup> Further, skin incision is begun at the hairline and proceeding inferiorly while staying anterior to the ears and down to the level of clavicles, bilateral periorbital incision is performed preserving the recipient patient's eyelids.
- Following the skin retraction, the vessels and nerves are identified and tagged with corresponding color-coded vessels loops.
- At the donor patient, the tongue is harvested with perimeter incision for transplantation to the recipient.
- Osteotomy is performed on the recipient using synthase proplan CMF patient-specific surgical guide and a cutting guidance is assisted on the donor patient with the use of intraoperative navigation.
- Removal of midface and mandible is finalized with an osteotome. The accuracy of cuts is checked using a sterilizable synthase proplan CMF bone model of recipient defect and fine adjustment is made using a bur.
- Bone, teeth, tongue, soft tissues, muscles of facial expression, etc., are transferred and followed by bone plating. The blood supply is reestablished and nerve coaptation is performed using microsurgery.
- Finally, soft tissue sutures are placed to close the procedure. Accurate alignment of patients bone using synthase proplan CMF ensures that the height, width, and projection of facial anatomy are restored as planned preoperatively.

## An Artificial Prosthesis to Reconstruct Donor Defects Following Facial Transplantation

The donor face reconstruction postoperatively must be emphasized. It is recommended that a donor's body must be restored to a pleasant appearance following organ harvesting.<sup>[16]</sup> The face provides person's identity and familial characteristics, thus making it a unique identifier. The failure to recognize a ones face leads to a bereavement reaction. Grieving by the donor's family members is done when brain death has been confirmed within the confines of the intensive care unit instead of immediately post harvesting. Therefore, there is optimum benefit to the transplant recovery team when the donor's facial features are reconstructed. The appearance of the donor's face and the development of a suitable facial prosthesis rank highly in surveys of health professionals involved in transplantation. In spite of discussion on altered identity, it has been suggested by recent public engagement exercises that identity issues are not likely to reduce access to donor faces.<sup>[17]</sup>

## Materials and Methods

### Stage 1

Primary impression is taken with alginate impression material in intensive care unit before transfer to the OT which is done within 30 min.

### Stage 2

Impression is then transferred to the laboratory where replica is made using plaster of Paris which is also done within 30 min.

### Stage 3

The facial plaster of Paris is replicated using silicon putty material by applying it over the plaster cast. It is removed from the cast once set and inserted into the plaster of Paris set within a prefabricated steel box. Further, when setting is complete, two layers of soft adhesive red dental carding wax are applied. This would reproduce the thickness of skin and the subcutaneous tissues required (approximately 5 mm).

Plaster of Paris is poured into this wax-coated molding box. After filling, a lid is placed so as to stop the plaster from shrinking, and the box left to set for approximately 30 min. This will help to produce the second cast for retention of the underlying characteristics of the face to the maximum.

### Stage 4

This is the final stage and it involves the mixing of a prosthetic colorant with silicone elastomer to obtain the required skin tone. A silicone "sandwich" is created by pouring silicone elastomer into the molding box and placing the second cast on top. This will set in 1 h approximately.

Even in its simplest form (involving soft tissue resurfacing), a donor facial graft will invariably result in the

loss of superficial facial characteristics such as eyebrows. Pre-operative harvesting of hair or addition of artificial hair to the prosthesis could be the alternatives. In addition, generic masks of all genders and facial types are also available to this donor-specific method of face transplant for the fabrication of the donor's prosthesis. These are constructed in case unforeseen constraints prevent the immediate fabrication of a donor-specific prosthesis.

### Role of dentist

#### Pre-operative

Analysis of mandible, maxilla, and occlusion provides better esthetics and functional results to the patient postoperatively.

#### Intraoperative

Oral surgeons play a major role in the reconstruction of midface, alignment of teeth, mandible, and maxilla including tongue and teeth, BSSO of mandible, osteotomy of maxilla, bone plating, and suturing. Reconstruction of donor's face is performed by the prosthodontics (as discussed earlier).

The new computer-assisted planning and execution system and synthase proplan CMF patient-specific surgical guide make it less likely to misalign the new set of jaws, bones, and also prevent various other reconstructive abnormalities.

#### Post-operative

Post-operative management of pain, mouth opening, lip closure, minor orofacial reconstruction and occlusion, and surgery can be better managed by a dentist.

### Medication<sup>[18]</sup>

For the prevention of rejection of graft, the patient should take various medications such as corticosteroid and cyclosporine. These would suppress the immune system. The drug levels are monitored in the blood so as to prevent any side effect. It is extremely critical for all the transplant patients to take all the prescribed drugs and to follow-up regularly. In addition, antibacterial, antiviral, and painkillers are required to be taken.

### Risks and discomforts<sup>[19]</sup>

#### General risks for transplantation

- Risks and side effects of drugs.
- Mood swings following transplant surgery.

#### Risks for Facial transplant<sup>[18,20]</sup>

- Psychiatric support must be proved to the patients before and after partial facial transplantation.
- Rejection.
- Identity issues.

#### Risks of taking transplant drugs for a lifetime<sup>[18]</sup>

- Infections.
- Diabetes.

**Table 4:** Compilation of published face transplant cases, most recent outcomes and complications

Year	Indication	Type	Survival
2005	Animal attack (dog)	Partial	Death 11 years postoperatively; drug complication
2006	Animal attack (bear)	Partial	Death, multiorgan failure
2007	Bilateral plexiform Nf	Partial	Alive
2008	Ballistic trauma	Partial	Alive
2009	Ballistic injury	Partial	Alive
2009	Burn	Partial	Death; cardiac arrest
2009	Electric injury	Partial	Alive
2009	Post rtx damage	Partial	Death; cancer recurrence
2009	Ballistic trauma	Partial	Alive
2009	Firework explosion	Partial	Alive
2010	Bilateral plexiform nf	Full	Alive
2010	Ballistic trauma	Full	Alive
2011	Electric injury	Full	Alive
2011	Ballistic injury	Partial	Alive
2011	Ballistic injury	Partial	Death 3-year post-surgery; suicide
2011	Burn, electric injury	Full	Alive
2011	Animal attack	Full+hand	Alive
2011	Ballistic injury	Partial	Alive
2012	Burn	Full	Alive
2012	Burn	Full	Alive
2012	Ballistic injury	Partial	Alive
2012	Ballistic injury	Full	Alive
2012	Burn	Full	Alive
2012	Vascular tumor	Partial	Alive
2013	Burn	Full	Alive
2013	Industrial injury	Partial	Alive
2013	Ballistic injury	Full	Alive
2013	Ballistic injury	Full	Death 1-year post-surgery; multiorgan failure
2013	Nf	Full	Alive
2013	Ballistic injury	Partial	Alive
2014	Ballistic injury	Full	Alive
2014	Burn	Partial	Alive
2014	Ballistic injury	Full	Alive
2015	Vascular anomaly	Full	Alive
2015	Electrical injury	Partial	Alive
2015	Burn	Full	Alive

(NF, neurofibroma, RTx, radiotherapy)

- Cancer.
- Kidney failure.

## The benefits of facial transplantation<sup>[20]</sup>

### Improved functionality

The physical functionality of the human face can be restored by face transplant surgery including the ability to breathe, swallow, speak, smile, and show other emotions.

### Rehabilitation of appearance

Restoration of a near-normal facial appearance can be achieved by face transplantation. This can help patients in regard gaining the confidence to return to their former lifestyles including social activities and jobs.

### Pain reduction and discomfort

Two major reasons why face transplant surgery should lead to less pain and discomfort. First, face transplant is not involving many surgeries and many recoveries unlike conventional surgeries. Second, it is not involved other surgical sites for autologous graft unlike conventional surgeries.

Table 4 shows Compilation of published face transplant cases, most recent outcomes and complications.<sup>[21-29]</sup>

## CONCLUSION

Facial transplantation is a life-changing procedure, whereas organ transfer is life-saving. The modern drug therapy and advance surgical technique have the potential to broaden up its clinical application and success rate which provides an esthetic appearance and gives a new life to the patient by improving his lifestyle and social status.

## REFERENCES

- Chenggang Y, Yan H, Xudong Z, Binglun L, Hui Z, Xianjie M, *et al.* Some issues in facial transplantation. *Am J Transplant* 2008;8:2169-72.
- Theodorakopoulou E, Meghji S, Pafitanis G, Mason KA. A review of the world's published face transplant cases: Ethical perspectives. *Scars Burn Heal* 2017;3:2059513117694402.
- Doctors perform first partial face transplant. *msnbc.com*; 2018 [18]. Available From: [http://www.nbcnews.com/id/10265941/ns/health-health\\_care/t/doctors-perform-first-partial-face-transplant/#.WuWX24hubIU](http://www.nbcnews.com/id/10265941/ns/health-health_care/t/doctors-perform-first-partial-face-transplant/#.WuWX24hubIU) [Last cited on 2016 Apr 20].
- Devauchelle B, Badet L, Lengelé B, Morelon E, Testelin S, Michallet M, *et al.* First human face allograft: Early report. *Lancet* 2006;368:203-9.
- Face Transplants. Documenting Reality; 2018[18]. Available from: <https://www.documentingreality.com/forum/f149/face-transplants-150380/>. [Last cited on 2017 Jan 20].
- Unal S, Agaoglu G, Zins J, Siemionow M. New surgical approach in facial transplantation extends survival of allograft recipients. *Ann Plast Surg* 2005;55:297-303.
- Dubernard JM, Owen E, Herzberg G, Lanzetta M, Martin X, Kapila H, *et al.* Human hand allograft: Report on first 6 months. *Lancet* 1999;353:1315-20.
- Morris P, Bradley A, Doyal L, Earley M, Hagen P, Milling M, *et al.* Face transplantation: A review of the technical, immunological, psychological and clinical issues with recommendations for good practice. *Transplantation* 2007;83:109-28.
- Barret JP, Gavalda J, Bueno J, Nuvials X, Pont T, Masnou N, *et al.* Full face transplant: The first case report. *Ann Surg* 2011;254:252-6.
- Lengelé BG. Current concepts and future challenges in facial transplantation. *Clin Plast Surg* 2009;36:507-21.
- Face Transplant Patient Eligibility - Brigham and Women's Hospital; 2018 [18]. Available from: <https://www.brighamandwomens.org/surgery/plastic-surgery/restorative-surgery/patient-eligibility-facial-transplant>. [Last cited on 2016 Jun 20].
- Renshaw A, Clarke A, Diver AJ, Ashcroft RE, Butler PE. Informed consent for facial transplantation. *Transpl Int* 2006;19:861-7.
- Petit F, Paraskevas A, Minns AB, Lee WP, Lantieri LA. Face transplantation: Where do we stand? *Plast Reconstr Surg* 2004;113:1429-33.
- Comprehensive Facial Transplant Video; 2018 [18]. Available from: <https://www.youtube.com/watch?v=kh4l-CztDG0>. [Last cited on 2001 Feb 21].
- Roche NA, Vermeersch HF, Stillaert FB, Peters KT, De Cubber J, Van Lierde K, *et al.* Complex facial reconstruction by vascularized composite allotransplantation: The first Belgian case. *J Plast Reconstr Aesthet Surg* 2015;68:362-71.
- Robertson JA. Face transplants: Enriching the debate. *Am J Bioeth* 2004;4:32-3.
- Clarke A, Simmons J, White P, Withey S, Butler P. Attitudes to face transplantation: Results of a public engagement exercise at the Royal Society Summer Science Exhibition. *J Burn Care Res* 2006;27:394-8.
- Face Transplant Patient Guide-Brigham and Women's Hospital; 2018[18]. Available from: [https://www.brighamandwomens.org/Departments\\_and\\_Services/surgery/services/PlasticSurg/Reconstructive/FaceTransplantSurgery/pdf/FaceTransplantPatientGuide.pdf](https://www.brighamandwomens.org/Departments_and_Services/surgery/services/PlasticSurg/Reconstructive/FaceTransplantSurgery/pdf/FaceTransplantPatientGuide.pdf). [Last cited on 2016 Feb 20].
- Pomahac MB, Surgery P, Surgery B, Hospital B, Bohdan Pomahac, MD-Brigham and Women's Hospital; 2018 [18]. Available from: [https://www.physiciandirectory.brighamandwomens.org/details/1250/bohdan-pomahac-plastic\\_surgery-restorative\\_surgery-bos](https://www.physiciandirectory.brighamandwomens.org/details/1250/bohdan-pomahac-plastic_surgery-restorative_surgery-bos). [Last cited on 2017 Jun 20].
- Face Transplant Benefits and Risks - Brigham and Women's Hospital; 2018 [18]. Available from: <https://www.brighamandwomens.org/surgery/plastic-surgery/restorative-surgery/benefits-and-risks-facial-transplant>. [Last cited on 2016 Apr 20].
- Infante-Cossio P, Barrera-Pulido F, Gomez-Cia T, Sicilia-Castro D, Garcia-Perla-Garcia A, Gacto-Sanchez P, *et al.* Facial transplantation: A concise update. *Med Oral Patol Oral Cir Bucal* 2013;18:e263-71.
- Sosin M, Rodriguez ED. The face transplantation update: 2016. *Plast Reconstr Surg* 2016;137:1841-50.
- Lantieri L, Grimbart P, Ortonne N, Suberbielle C, Bories D, Gil-Vernet S, *et al.* Face transplant: Long-term follow-up and results of a prospective open study. *Lancet* 2016;388:1398-407.
- Garrett GL, Beegun I, D'Souza A. Facial transplantation: Historical developments and future directions. *J Laryngol Otol* 2015;129:206-11.
- Gordon CR, Siemionow M, Papay F, Pryor L, Gatherwright J, Kodish E, *et al.* The world's experience with facial transplantation:

- What have we learned thus far? *Ann Plast Surg* 2009;63:572-8.
26. Khalifian S, Brazio PS, Mohan R, Shaffer C, Brandacher G, Barth RN, *et al.* Facial transplantation: The first 9 years. *Lancet* 2014;384:2153-63.
27. Shanmugarajah K, Hettiaratchy S, Clarke A, Butler PE. Clinical outcomes of facial transplantation: A review. *Int J Surg* 2011;9:600-7.
28. Roche NA, Blondeel PN, Van Lierde KM, Vermeersch HF. Facial transplantation: History and update. *Acta Chir Belg* 2015;115:99-103.
29. Pomahac B, Pribaz J, Eriksson E, Bueno EM, Diaz-Siso JR, Rybicki FJ, *et al.* Three patients with full facial transplantation. *N Engl J Med* 2012;366:715-22.

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