



Face Transplantation: A Leading Surgeon's Perspective

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ABSTRACT

Twenty years of experience in the field of vascularized composite allografts (VCA) leading to the first US face transplantation is presented. Different experimental models and cadaveric studies in the VCA models are outlined. Development of face transplantation protocol and consent forms for Institutional Review Board approval is discussed. Different scientific, regulatory, and financial considerations that were required before approval of face transplantation are presented. The effort, importance, and role of multidisciplinary team approach are emphasized. Finally, the technical aspects of face transplantation and related immunologic and functional outcomes of the patients are discussed.

FACE TRANSPLANTATION, as a new concept in facial reconstruction and a novel procedure in the transplantation field, requires years of expertise, preparation, and many challenges to be overcome. I would like to share the process of preparing to perform first US face transplantation from the perspective of surgeon who led the transplantation team on December 8, 2008 (Fig 1).¹

Over the past 20 years, my laboratory has developed many models of composite tissue allotransplantation and tested different types of immunosuppressive protocols and tolerance-inducing strategies.^{2,3} These models included limb transplantation, vascularized skin transplantation, joint transplantation, vascularized bone transplantation, and facial allograft transplantation models. We have concentrated on different types of face transplantation models that would be relevant in the future to the facial defects of patients exposed to severe trauma, burns, or cancer extirpation.

Thus, we started with testing full face transplantation with scalp, followed by hemi-face with facial augments such as the ears; next, more complex models representing composite deficits of skin and bone, for example, face combined with calvarial bone, were developed and tested under different immunosuppressive protocols. These studies proved the feasibility of face transplantation as well as facial augments such as the ears.

Finally, the model of midface transplantation, where the nose was transplanted with midfacial components of premaxilla, would apply to the cases often seen in a trauma scenario, where lack of functional components of nose and lips, which cannot be reconstructed in a conventional manner, would apply to the candidates of face transplantation. Following the years of experimental face transplantation in rats, under different experimental protocols of immunosuppression, tol-

erance-inducing strategies, and minimal immunosuppression treatments, the next natural step was to move to the anatomy lab to assess the feasibility of face transplantation in a cadaveric model.

We started our set of experiments with an outline of full face and scalp transplantation in a cadaveric model to find out the extent of anatomic dissections required, vascular territories of neurovascular pedicles, as well as the amount of skin needed for face transplantation. We found that to transplant an entire face with scalp, we would need 1192 cm² of surface area to cover the full face.⁴⁻⁶

Our next interest was to find out how long it would take to perform face transplantation in a cadaveric model; working in the anatomy laboratory in the scenario of donor and recipient teams, we could estimate the average time of a facial flap procurement, as well as estimate timing of dissection of the arteries, veins, and nerves. The second team worked on creation of the defect in the recipient, and the timing on this donor-recipient mock transplantation was estimated to be 5 to 6 hours. To further prove our expertise in understanding the potential challenges in face transplantation, we responded to the question of the identity transfer. To be ready to respond to the potential family request of how the recipient will look and if the donor face will be exactly transferred to the recipient, creating potential problem of identity, we performed additional cadaveric

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Fig 1. Timeline to first US face transplantation.

studies in the anatomy laboratory where we tested, on glass and Styrofoam head models, the issue of identity transfer. We found that the transplanted donor face to the recipient would be a mixture of the features of the donor and recipient, and that is how we present it to the families of those who would be donating faces.

Once we proved in the lab that we were able to perform the transplant, the next challenge was to develop a written protocol and submit the protocol to the Institutional Review Board (IRB). It took an entire year of meetings and explanations with Cleveland Clinic's IRB committee, which resulted in several amendments to the original protocol. The protocol was approved after 1 year following submission, and the approval date of October 15, 2004, was the historical date of the world's first approval to perform face transplantation in humans. With our Cleveland Clinic IRB protocol in hand, we set forth to solicit support from the local Organ Procurement Organization (OPO).

The OPO approval process was an unexpected, challenging task. The process was much longer than expected. The challenges met during the meetings with the OPO board, as well as the specific requirements posted to receive OPO approval, took many years. The local OPO was not ready to approve the protocol, after we received IRB approval in 2004. This resulted in an alternate plan to solicit the help of our neighboring OPOs in Ohio, Pennsylvania, and Michigan. Their support and the first approval were received in 2006—two years after IRB approval.

Three organizations approved our face transplant protocol and were ready to list the patients; however, logistically, it was very difficult to organize the transplant procedure for the first patient outside of our local OPO since our goal was to perform face transplantation surgery between the donor and recipient in two operating rooms, side by side, on the Cleveland Clinic premises and to have full control regarding the dignity in procurement of the face in the donor, as well as to have immediate access to the recipient, to minimize ischemia time, as well as maximize the effort of the procurement team of plastic surgeons to work in the known environment, since it was a complex microsurgical procedure required for procurement of the facial allograft. Limited approval from LifeBanc (our local OPO) was received in January 2007, and the final letter of approval

was given in January 2008, which allowed for listing donors from the entire territory of LifeBanc and opened the opportunity to search for the face transplant candidate. The first US face transplant patient, Connie Culp, was listed on August 28, 2008.

There are currently 18 patients, worldwide, who have received face transplantation; however, the patient selection process and exclusion/inclusion criteria are probably the most challenging tasks when discussing face transplantation. Among these 18 patients, two have lost their lives, and this has to be emphasized when discussing face transplantation. The first patient, who was the second face transplant performed in China, had rejected the face due to the fact that he was noncompliant with immunosuppression, was advised to take herbal medications by the village healer where he lived, and by the time he got to the hospital where the transplant had been performed, the face was rejected and the patient died. The second patient died in Paris, France, after transplantation of concomitant face and bilateral hand allografts. This patient died due to the complication of severe infections a few months following transplantation. These two cases, where the patients have lost their lives, for a so-called nonvital organ transplantation, are very important to discuss when the vascularized composite allograft field is still developing, and we want to be sure that other protective measures can be taken and the patients will understand the high risk of face transplantation.

When considering a potential patient for face transplantation, a major question may also be whether face transplantation should be carried as primary reconstruction or a surgery of last resort when all forms of conventional reconstruction has been attempted and failed. Another important consideration may be the type of disfigurement; there are three possible major indications for face transplantation that must be discussed when evaluating face transplant candidates: primary functional deficits (such as lack of nose, eyelids, lips), aesthetic defect alone (a severely burned patient), or both functional and aesthetic deficit.

Our patient, Connie Culp, presented with a severe functional deficit, with lack of nose, hard palate, lower eyelids, and upper lip, which made her unable to drink from a cup. She was dependent on gastric tube for feeding and she had

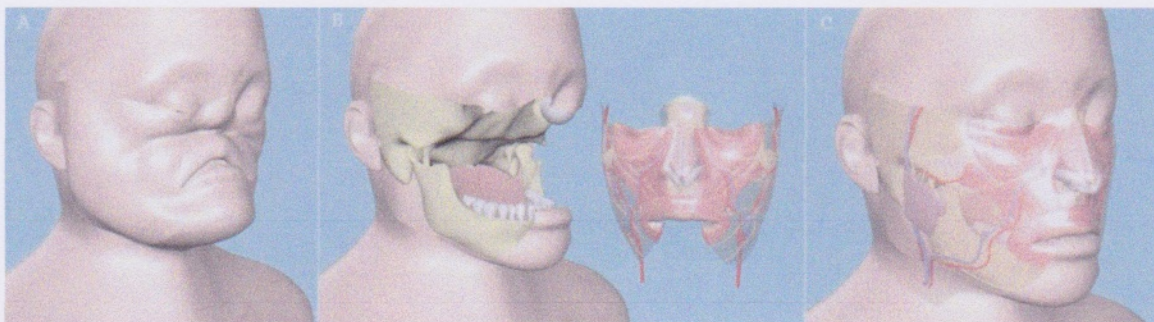


Fig 2. Diagram depicting first US face allotransplantation. (A) Severe facial defect in the recipient before face transplantation. (B) Left: deficit of the central part of the face after removal of scar tissues, hardware, and soft tissue and bony elements of previous surgical reconstructions. Right: full composite face transplant from the donor with functional units of nose, upper lip, lower eyelids, as well as skin, muscles, maxilla, zygomas, and arteries, veins, and nerves. (C) Recipient outcome after reconstruction of facial deficit with facial allograft following musculoskeletal fixation and connection of arteries, veins, and nerves between the donor and recipient.

a tracheostomy and recurrent upper respiratory infections. This severe disfigurement, which was not successfully repaired with conventional techniques due to three-dimensional craniofacial deficit, left the patient with significant functional deficit, as well as aesthetic deficit (Fig 2).

One of the most important issues related to patient selection is the inclusion or exclusion of blind patients. Is limited vision or blindness a restriction when considering patients for face transplantation? Out of 18 patients transplanted thus far, three were blind and two had limited vision. This brings challenges regarding physical therapy, cortical reeducation, and patient surveillance of the graft; thus, functional outcomes of these patients have to be carefully monitored.

The way a new procedure is presented to the public can strongly influence public opinion. Thus, the announcement of the world's first IRB approval of the protocol for face transplantation on October 15, 2004, received an overwhelming response and interest from media all over the world. The media experience thus far was overwhelmingly positive, both to the transplant team as well as to the patient, and this facilitated opening new programs of face transplantation around the country.

There are still many unknown challenges for face transplantation.⁷ This review, based on over 20 years of experience in preparation for face transplantation, shows that many ethical, legal, and financial issues had to be resolved

before this unique, novel transplantation procedure could be performed. Today, at almost 3 years posttransplant, our patient's functional, aesthetic, and social outcome is excellent, and this is the most rewarding achievement for the entire team and a unique privilege for the leading surgeon.

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