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Review

Facial restoration by transplantation

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ABSTRACT

Hundred years ago, Sir Harold Gillies laid a foundation to the modern plastic surgery trying to reconstruct facial defects of severely disfigured soldiers of World War I. Some years later, Joseph Murray experimented with rejection of skin grafts aimed for treatment of burned patients who sustained their injuries on battlefields of World War II. In 1954, the acquired expertise and intensive research allowed him to perform the first successful kidney transplantation in the world at Peter Bent Brigham Hospital in Boston. For his achievements in organ transplantation he was awarded Nobel Prize in 1990. The face transplantation appears to be a natural evolution of the work of these two extraordinary plastic surgeons. The first case of partial face transplant from 2005 in France revealed the world that facial restoration by transplantation is superior to conventional reconstruction methods. Since 2009, our team has performed 7 cases of face transplantation at Brigham and Women's Hospital, which is to our best knowledge the largest living single center face transplant cohort in the world. In this article, we want to reflect on the experience with face transplantation at our institution from the past years. We aim to briefly review the key points of the know-how which was given to us from the care of these unique patients.

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Introduction

A century ago, Sir Harold Gillies, one of the fathers of plastic surgery, faced the challenge of facial reconstruction in order to help wounded soldiers of World War I.¹ Since then, the field continued to evolve and plastic surgeons are nowadays using different methods of reconstruction including skin grafting, local and distant pedicled flap coverage, expansion and free tissue transfers.² These methods, also called conventional

reconstruction, usually follow the reconstructive ladder. The conventional reconstruction seems to provide good treatment options and satisfactory results when only one layer of reconstruction (e.g. skin), and in limited amount is desired. However, patients sustaining devastating injuries to the face often lack multiple layers, and 3-dimensional structures (skin, muscle and bone) of the face, which are difficult to be reconstructed by conventional means of reconstruction. Additionally, the facial reconstruction proves to be very problematic

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when anatomically complex parts of the central midface are involved, such as the lips, nose and eyelids, frequently leading to suboptimal functional and esthetic outcomes.³

An important milestone in facial reconstruction was reached in 2005 in France. A team led by Dubernard performed the first partial face transplantation in a woman whose face was severely injured after a dog attack.⁴ This breakthrough was followed by more than 35 face transplantation procedures performed worldwide.⁵

Since 2009, we have performed 3 partial and 4 full face transplants at our institution (Fig. 1). To achieve best possible outcomes for our patients, we respect surgical principles of safety (preserving salvage options in case of graft failure), technical feasibility (facial artery based allografts) and preservation of functional units (integration into the design of facial allograft) leading to functional and esthetic reintegration.^{6,7}

Face transplanted patients

We are convinced that face transplantation procedures, due to their complexity, should be performed by multidisciplinary teams. In our center, specialists from multiple disciplines are involved in patient selection and care: Plastic and Reconstructive Surgery, Transplant Surgery and Medicine, ENT, Psychiatry, Social Work, Radiology, Infectious Disease, Rehabilitation, Speech/Swallow Therapy and many more. A face transplant candidate is deemed eligible for face transplantation if consensus is reached by more than 50% of the team members.⁸

Following seven patients were able to meet our inclusion criteria⁹ and were transplanted with facial allografts.

Patient 1

Our first patient was transplanted in April 2009. This 59-year-old man sustained severe electrical burn injuries leading to a

complex bone and soft-tissue defect of the midface. The transplanted partial face allograft included nose, maxilla, upper lip and cheeks.¹⁰ After 8,5 years of follow-up, the graft is still functional with significant restoration of nasal breathing, speech, feeding, sensation and animation.

Patient 2

The second patient underwent in our institution the first full face transplantation in the USA. This 25-year-old blind male lost due to an electrical burn all soft tissues of the face, eyelids, left eye, nose, lips, teeth and a large portion of left temporoparietal scalp. Consequently, he had no nasal breathing, no facial expression, inability to close the mouth and impaired speech. In March 2011, we could successfully replace his facial defect with a full face allograft.¹¹

Patient 3

Our third patient's face was also disfigured by an electrical burn. His facial defect comprised skin over forehead, cheeks, eyelids and soft tissues of the nose and upper/lower lips. At the age of 30 years, he received in April 2011 a full face transplant.¹¹ His functional and esthetic outcome is comparable to a normal person at 5 years follow-up and the patient gets barely noticed in public.

Patient 4

The third full face transplant in our institution was given to a 57-year-old blind lady whose face was mauled by a chimpanzee. The patient lost her nose, eyelids, both eyes, maxilla and lips leading to similar functional deficits as in patient 2. Besides of a full osteomyocutaneous facial allograft, bilateral upper limbs were concomitantly transplanted in May 2011. Unfortunately, due to septic pneumonia, the limbs had to be removed on postoperative day 5 while the face could be



Figure 1 – Outcomes of our patients receiving partial or full face transplant between 2009 and 2014. The top row shows the pretransplant situation after conventional reconstruction attempts. In the bottom row, the results at maximal follow-up after face transplantation are presented.

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