Current Concepts and Future Challenges in Facial Transplantation

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• Face transplantation • Functional results • Immunotherapy
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> *"The face is always of an Other…"* Emmanuel Levinas, philosopher (Ethique et Infini. Paris: Fayard; 1982)

In the writings of ancient Greek philosophy and, more recently, in the texts of leading contemporary thinkers, the face has always embodied the essential expression of humanity. Individual by nature and expressing each single emotion of its owner at any given moment in a unique relationship with the exterior world, the face enjoys an unequalled symbolic value in the midst of a company of animated organs as bearer of the soul. Envisaging transposing the face of one person to another, albeit in order to restore the appearance of a human being, becomes an enterprise that is audacious, provocative, and transgressive. Constrained to the esoteric world of myth and legend until the dawn of the second millenium, such an intervention nevertheless has progressively entered the spheres of mere probability rather than possibility with the advance of science.

When the first facial graft was performed in Amiens, France, on November 27, 2005,[1] this surgical event, which largely surpassed medical boundaries, raised many questions. It did not fail, and rightly so, to launch a society-wide ethical and philosophic debate.[2] Since then three facial allotransplantations (FATs) have been performed, first in Xian, China,[3] then in Paris,[4] and, more recently, in Cleveland, Ohio, in the United States.[5] Today, as emotions subside, a retrospective analysis of the results obtained from those successive clinical experiences enables an initial account of the techniques, results, and cost-benefit balance of FATs.

This article addresses four fundamental issues raised in the medical world by the principle of facial transplantation, even though this procedure has long since passed from the stage of the conceptual virtual world of yesteryear to the surgical reality of today:

- The first issue is technical and concerns the microsurgical feasibility of composite tissue transfers to the face. This opportunity is analyzed from a perspective of interest not only in the static restoration of surfaces and volumes but also in restoring the vectors of facial expression.
- The second issue is biologic and concerns the possibility of medically limiting the rejection of a composite tissue allograft (CTAG), reputedly extremely immunogenic due to its skin cover.
- The third issue is functional and neurophysiologic and raises the question of a possible integration of a facial allograft (FAG) not only in the body scheme of the recipient but also in the day-today life of facing the reality in the mirror and in the gaze of fellow human

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beings. This is precisely the point where essential fears of seeing a massive transfer of the identity of the donor to the recipient, along with the organic transfer of visible nonautologous tissues, come to light. The dread of a major psychologic conflict of personality, therefore, is expected.

- The last issue is ethical and questions the legitimacy of high-risk surgery that mutilates the image of one patient who is about to die in order to pass it to one who, deprived of a face, is about to receive it at the price of the uncertainty of a future existence resulting from the risks engendered by the immunosuppressive treatment and the unknown longevity of the allograft.

Addressing these four cardinal issues and looking beyond current achievements, the author outlines the needs for further research, potential new indications, and future technical challenges concerning new FAGs.

TECHNICAL FEASIBILITY AND JUSTIFICATION OF INDICATIONS FOR FACIAL ALLOGRAFTS

Under the apparent continuity of its form and contours, the face is surgically divided into distinct anatomic units, each of which must, in principle, be the object of a separate reconstruction to be cosmetically perfectly individualized in the rebuilt face. Following this rule, each loss of facial substance limited to a single anatomic unit easily can be repaired with one or several reliable alternative restoration techniques, whose indications, advantages, and disadvantages have been described abundantly. Usually, when only one unit is missing, for example, the nose, lips, eyelids, cheeks, or forehead, it can have its contours, surface, and multitissular architecture elegantly restored with the help of autologous surrounding tissues, with steadfast morphologic results and a satisfactory cosmetic appearance. This is not always the case when a tissue defect is more substantial and concerns several adjacent anatomic units. In spite of the considerable contribution offered, in such circumstances, by microsurgical transfers, several operative procedures are then necessary to restore the bony support of the missing units and to reposition superficially, side by side, the corresponding soft tissues. Despite multiple reinterventions, the results of these daring undertakings are poor, more than often cosmetically imperfect, and nearly always incapable of reviving the dynamics of the lost facial harmony.[6] A face reconstructed in this manner invariably takes on the appearance of a mosaic of juxtaposed cutaneous units, often different in color and texture, separated by multiple scars at wound edges and robbed of the subtle movements required for the oral function and facial expressivity. Precisely because the 3-D multitissular architecture of the face is of unrivalled complexity compared with the rest of the human body, it is justifiable to turn to composite tissue allotransplantation (CTA) when loss of substance extends over several anatomic units and deprives a patient of several cardinal orofacial functions, such as competent feeding, intelligible speech, and spontaneous nonverbal expression. Experts in complex facial reconstruction have recognized the limits of the microsurgical possibilities in the domain of severe disfigurement.[6,7] In the light of these limits, FAT seems more an act of surgical humility than a pretentious action destined to spectacularly demonstrate extreme microsurgical talent. When, despite all its creativity and know-how inherited from peers, the hand of a surgeon considers itself incapable of restoring the genius of nature, is it not better, perhaps, to accept in all humility that only a loan of the genius of nature itself might enable it to further its science and art?

Anatomically, the face rests on rigid skeletal bases and assembles, narrowly schemed under the skin, the orbicular muscular rings that circle the lips and the eyelids, the multidirectional slings of the elevator and depressor muscles organized around the oral cleft, and the gravitational and antigravitational muscles of the eyebrows. Connected by the fibrous sheath of the superficial musculoaponeurotic system that coordinates their movements, each of those muscles acts on distinct adipose cushions that are distributed in cellular subcutaneous tissue, and the dynamic mask thus constituted is supported in various places by retaining ligaments that are responsible for the expressive mimic of the face. The principle of each FAT technique is first to harvest, then to transfer onto the remaining facial structures of the recipient, all those tissue elements, cut to size, without severing them from the skin surface or from the deep mucosal and periosteal planes. The surgical transposition of these structures is technically possible because of the rich vascularization of the face, which consists of several anastomotic arterial and venous networks, distributed in multiple longitudinal or transverse arcades around the oral, nasal, and palpebral clefts, running between the facial, transverse facial, and superficial temporal vessels. Around the orbital region, the main arterial axes branch on terminal segmental branches of the ophthalmic arteries, arising from the internal carotids. The efficiency of functional complement of that vascular network