Dental considerations and the role of prosthodontics and maxillofacial prosthetics in facial transplantation

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ABSTRACT

Background. Facial transplantation (FT) is a challenging reconstructive endeavor that requires the expertise of a multidisciplinary team. The specific role of maxillofacial prosthodontists has not yet been reported in detail.

Methods. This review considers the contributions of prosthodontists throughout the FT process, from patient selection and dental evaluation to long-term dental rehabilitation of the transplant patient postoperatively. Moreover, considerations of dental management are evaluated.

Results. In the almost 40 FT reported in the literature, the most consistently documented contribution by prosthodontists is the fabrication of a donor mask to maintain donor integrity. Though infrequently reported, prosthodontists have the potential to plan and perform a variety of dental procedures and follow-up plans.

Conclusions. When applicable, facial transplant teams are tasked with providing optimal stomatognathic function and dental occlusion to recipients with severe facial disfigurement. The maxillofacial prosthodontist’s contribution is crucial to the long-term dental restoration of the edentulous facial transplant candidate, in addition to the fabrication of the donor mask which fulfills the team’s ethical responsibilities.

Practical Implications. Maxillofacial prosthodontists play a pivotal role in facial transplantation, particularly when jaw segments are intended for transplantation.

Key Words. Facial transplantation; facial disfigurement; dental rehabilitation; immunosuppression; donor mask; maxillofacial prosthodontics.

Facial transplantation (FT) has become a feasible reconstructive option for patients with severe facial disfigurement. However, because each candidate has a unique defect, each procedure poses a different challenge. The complex nature of FT requires the expertise of a multidisciplinary team. Moreover, the surgical team is a dynamic group of specialists and subspecialists that vary on a case-by-case basis. The contributions of an oculoplastic surgeon during a FT that included the eyelids have been previously described, and reports of bone-containing FT have highlighted the role of craniofacial surgeons.

Although less involved intraoperatively, maxillofacial prosthodontists are an important member of the FT team. Their close involvement is of particular importance when the donor or recipient has partially or fully edentulous jaw segments. We describe the role of the prosthodontist during candidate selection, preoperative planning, peritransplant mask fabrication, and posttransplant dental rehabilitation. Furthermore, we briefly review the lessons learned from the short history of FT regarding the inset of bone-containing facial allografts, which preclude functional occlusion and dental rehabilitation.

HISTORY OF ANAPLASTOLOGY AND FACIAL PROSTHETICS

For millennia, prostheses have disguised facial disfigurements that otherwise result in social ostracism. Sixteenth-century reports by Paré describe the design of prosthetic limbs and facial masks for
wounded soldiers. In the early 1900s, Tetamore\textsuperscript{5} presented eyeglasses as a prosthetic component for optimal fit, and many contemporaries fabricated new chemical materials to improve appearance. During World War I, advancements in reconstructive surgery lagged behind the high prevalence of severe facial trauma. Consequently, dentists with advanced prosthetic skills provided wounded veterans with a suitable esthetic appearance until surgical intervention became a feasible option, if ever.\textsuperscript{6} English sculptor-turned-prosthetist Derwent Wood set the esthetic standards of the time,\textsuperscript{7} and dental surgeons developed flexible and durable materials such as silicone elastomers. In the 1980s Brånemark\textsuperscript{8} coined the term “anaplastologist” to describe dental technicians/medical artists who worked alongside maxillofacial prosthetists to fabricate facial prostheses. Throughout history, the aim of facial prosthodontists has been the reintegration of the facially disfigured back into society, whenever surgical reconstruction was unavailable, unsuitable, or refused.

**PRETRANSPLANTATION**

**Candidate evaluation and selection**

Early involvement of the prosthodontist in the patient selection phase is useful for determining a candidate’s oral health, because dental disease may increase the risk of developing infection in recipients who are immunosuppressed.\textsuperscript{9-11} In a survey of US solid-organ transplantation (SOT) centers, 80% of respondents requested a dental evaluation before transplantation; in addition, posttransplantation sepsis from a suspected dental source was acknowledged in 27% of cases.\textsuperscript{12} Thus, a thorough dental history should be obtained to identify predictors of noncompliance to preventive and postprocedure oral/dental instructions.\textsuperscript{10} SOT evaluations also focus on radiology to identify reduced salivary flow and related pathologic processes and to quantify the risk of developing bleeding and infection related to oral surgery.\textsuperscript{15} Active oral/dental disease must be effectively treated before transplantation, because the immunosuppression regimen may increase the risk of developing systemic complications.\textsuperscript{10,11,14,15} A care plan should be developed while the patient is on the wait list and should be continued after transplantation.\textsuperscript{10,16} As an added benefit, the prosthodontist can complement the teamwide evaluation of the candidate’s support system, an important factor in oral health maintenance.\textsuperscript{17}

Evaluation of the edentulous candidate for transplantation

Despite the latest advances, edentulism continues to be highly prevalent.\textsuperscript{18} Stomatognathic function and quality of life are affected by the absence of functional dentition or lack of adequate prosthetic rehabilitation,\textsuperscript{19,20} which may influence the outcome and complexity of oral rehabilitation. The American College of Prosthodontists developed a classification for edentulous and partially edentulous patients, Prosthodontic Diagnostic Index, that considers the main factors to be evaluated\textsuperscript{21,22} (Box 1). In partially edentulous patients, main considerations include the location and extent of the edentulous area, the overall condition of abutment teeth, the state of occlusion, and the characteristics of the residual maxillary and mandibular ridges.\textsuperscript{21,22}

**PERI-TRANSPLANTATION**

**Donor mask**

Unlike other forms of transplantation, facial allograft procurement leaves the donor void of his or her most unique, socially identifying feature. This substantial disfigurement becomes apparent to those who may interact with the donor’s body.\textsuperscript{23} Fabrication of a prosthetic donor mask offers a humanistic component to the donor’s remains and maintains dignity for all involved (Figure 1). Restoring donor integrity is an ethical responsibility among FT teams and is a legal obligation in certain countries.\textsuperscript{24} Since the first FT performed in 2005,\textsuperscript{25} most teams have adopted this additional step that, should the family desire an open-casket funeral, allows for a respectable appearance of the donor.\textsuperscript{26-28} (Table 1).\textsuperscript{11,26,28-37} It is a relatively easy, inexpensive procedure that does not increase overall operative time and has few, if any, drawbacks.\textsuperscript{23,38} Moreover, some argue that donor-likeness restoration may aid in achieving greater social acceptance of FT, because it addresses common public concerns that arise when considering organ donation.\textsuperscript{18}

Two main techniques can be used, depending on the preferred materials and workflow. Quilichini and colleagues\textsuperscript{29} described a “traditional” method in which an irreversible hydrocolloid impression

**ABBREVIATION KEY**

CT: Computed tomographic.
FDP: Fixed dental prosthesis.
FT: Facial transplantation.
SOT: Solid-organ transplantation.
3D: 3-dimensional.
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