A Computerized Approach to Facial Transplantation: Evolution and Application in 3 Consecutive Face Transplants

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INTRODUCTION: Face transplant (FT) candidates present with unique anatomic and functional defects unsuitable for autologous reconstruction, making the accurate design and transplantation of patient-specific allografts particularly challenging. In this case series, we present our computerized surgical planning (CSP) protocol for FT.

METHODS: CSP, computer-aided design and manufacturing, intraoperative navigation, and intraoperative computerized tomography have been successfully incorporated into a comprehensive protocol. Three consecutive FTs were performed. CSP and postoperative results were compared using computerized tomography-derived cephalometric measurements, and the literature was reviewed.

RESULTS: Two full and 1 partial FT were successfully performed using the CSP protocol. CSP facilitated the execution of FT with minor angular and translational cephalometric variations on immediate postoperative imaging. Our evolving experience was accompanied by a decreased reliance on cadaveric simulation, from 10 mock transplants and a research procurement before the senior author’s first clinical FT (2012) to 6 mock transplants and no research procurement before the third FT (2018). Operative time was significantly reduced from 36 to 25 hours, as was the need for major orthognathic surgical revision. This reflects the learning curve and variable case complexity, but is also representative of improved planning and execution, complemented by the systematic incorporation of CSP into FT.

CONCLUSION: A CSP protocol allows for refinement of operative flow, technique, and outcomes in partial and full FT. Standards for functional and esthetic outcomes are bound to evolve with the field’s growth, and computerized planning and execution offer a reproducible approach to FT through objective quality assurance.

Early Cleft Repair Versus Nasoalveolar Molding: Comparing Preoperative Severity and Postoperative Results Utilizing a Computer Engineered AI System

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BACKGROUND: Early cleft lip repair (ECLR) can be performed safely and effectively. One persistent question is whether ECLR may be offered to wide unilateral complete clefts who historically would have received nasoalveolar molding (NAM). This study aims to compare the preoperative cleft severity of ECLR patients to those who underwent NAM pretreatment and compare postoperative outcomes.

METHODS: Unilateral CL patients (January 1, 2005, to September 11, 2018) were retrospectively reviewed and divided into 2 groups: ECLR (age <3 months) and presurgical NAM with CL repair (age 3–6 months). Pretreatment CL severity was assessed using an AI computer engineered system that calculated cleft width ratios (CWRs, pretreatment cleft width divided by commissure width). For further analysis, a second subset of wide complete cleft lip patients undergoing ECLR (excluding incomplete clefts) was created to compare to the NAM group.

RESULTS: Seventy-four ECLR patients and 25 NAM patients (average age at repair 32.24 and 117.56 days, respectively) met inclusion criteria. Mean CWR was 0.456 for ECLR patients and 0.501 for NAM patients ($P = 0.165$). The ECLR subgroup considering only patients with complete cleft lips had a mean CWR of 0.520, suggesting that this group had more severe clefts. The ECLR subgroup’s average lip length, frontal nasal breadth, commissure length, nostril breadth, nostril width, and nasal angle symmetry ratios were compared to the NAM group’s postoperatively. The average lip length, frontal nasal breadth, and commissure length symmetry ratios for the ECLR subgroup of 27 complete clefts were 0.88, 1.05, and 0.92, respectively, compared to 0.93, 1.08, and 0.89 for the NAM group ($P = 0.181$, $P = 0.526$, $P = 0.378$). The average nostril breadth, nostril width, and nasal angle ratios among the ECLR subgroup were 1.09, 1.17, and 1.12, respectively,