Pursuing Mirror Image Reconstruction in Unilateral Microtia: Customizing Auricular Framework by Application of Three-Dimensional Imaging and Three-Dimensional Printing

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INTRODUCTION: The advances in three-dimensional imaging and three-dimensional printing technology have expanded the frontier of pre-surgical design for microtia reconstruction from two-dimensional curved lines to three-dimensional perspectives. This study presents the algorithm of combining three-dimensional surface imaging, computer-assisted design, and three-dimensional printing to create patient-specific auricular frameworks in unilateral microtia reconstruction.

METHODS: Patients with unilateral microtia, who underwent auricular reconstruction with MEDPOR® implant, were enrolled. Three-dimensional image of the patient's head was captured by the 3dMDcranial® and virtual sculpture carried out using the Geomagic® Freeform® software and Touch™ X Haptic device for fabrication of the auricular template. Each template was tailored according to the patient's unique auricular morphology. The final construct was mirrored onto the defective side and printed out with biocompatible acrylic material.

RESULTS: During the surgery, the prefabricated customized template served as a three-dimensional guide for surgical simulation and sculpture of the MEDPOR® framework. The template was used to simulate the appearance after skin draping and helped the surgeon to assess the sufficiency of soft tissue coverage. Symmetrical and good aesthetic results with regards to auricular shape, projection, and orientation can be obtained using this method.

Conclusion: The combination of three-dimensional imaging and manufacturing technology with the malleability of MEDPOR® has surpassed existing limitations resulting from the use of autologous materials and the ambiguity of two-dimensional planning. This approach allows surgeons to customize the auricular framework in a highly precise and sophisticated manner, taking a big step closer to the goal of mirror-image reconstruction for unilateral microtia patients.